NORTH AMERICAN COLLEMBOLOUS INSECTS OF THE SUBFAMILIES ACHORUTINAE, NEANURINAE, AND PODURINAE.

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The present paper treats of all the known species of North American Poduridae, with the exception of the subfamily Onychiurinae.

Special acknowledgment is due to Dr. A. D. MacGillivray, of the University of Illinois, from whom I have received large collections of notable importance.

Through the courtesy of Prof. Henry F. Nachtrieb, of the University of Minnesota, I have obtained for study many of the species described by Guthrie.

From Mrs. F. L. Harvey, of Orono, Maine, I acquired the large collection made by Professor Harvey.

Through the kindness of Mr. Samuel Henshaw I was enabled some years ago to study all of Packard's material in the Museum of Comparative Zoölogy.

Cotypes have been deposited in the United States National Museum, Washington, District of Columbia, and in the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

Synopsis of Subfamilies.

COLLEMBOLA.

Body elongate; segmentation evident; the nine body segments being distinct as a rule; the exceptions applying only to the last two or three abdominal segments.
Suborder ARTHROPLEONA Börner.

Body segments essentially similar; prothorax similar to the other segments and with setae dorsally; never reduced or naked; postantennal organ usually present; antennae short, four-segmented; mouth parts mandibulate or piercing-suctorial; unguiculus frequently absent; furcula present or absent; when present, clearly appended to the fourth abdominal segment; anal spines often present; integument tuberculate, not thickened in the form of sclerites; scales absent.
Family PODURIDAE Lubbock, Börner.

Head and body without pseudocelli; eyes present or absent; postantennal organs usually present; furcula present or absent; sense-organ of third antennal segment with sense-rods, but without sense-cones and outer papillae.
  Head prognathous; unguiculi present or absent; furcula not extending beyond the ventral tube; dentes not divided into two segments; not ringed distally, not bowed.
    Mouth parts mandibulate, not projecting in a cone; mandibles with a molar surface; furcula present; anal spines usually present.
      Subfamily ACHORUTINAE Börner, 1901*b* (p. 478).
    Mouth parts mandibulate or piercing-suctorial, projecting in a cone in most of the genera; mandibles small or absent, without molar surface........................Subfamily NEANURINAE Börner, 1901*b*.
      Anal segment relatively small; supra-anal valve rounded, not bilobed; furcula present or absent; segmental tubercles absent.
        Tribe PSEUDACHORUTINI Börner, 1906 (p. 498).
      Anal segment relatively large; supra-anal valve bilobed; unguiculus absent; furcula absent; segmental tubercles present; buccal cone present; anal spines absent..Tribe NEANURINI Börner, 1901*d* (p. 507).
  Head hypognathous; unguiculi absent; furcula extending beyond the ventral tube; dentes two-segmented, ringed distally, bowed outward.
    Subfamily PODURINAE Börner, 1906 (p. 513).
Head and body with pseudocelli; eyes absent; postantennal organs almost always present and well developed; mouth parts mandibulate, mandibles with molar surface; furcula absent or rudimentary; sense-organ of third antennal segment with sense-rods, sense-cones, and often with outer papillae; anal spines usually present............................Subfamily ONYCHIURINAE Börner, 1906.

Subfamily ACHORUTINAE Börner.

Achorutini BÖRNER, 1901*a*.
Achorutinae BÖRNER, 1901*b*.
Hypogastrurinae BÖRNER, 1906.

KEY TO GENERA OF ACHORUTINAE.

1. Furcula present; eyes present..2.
   Furcula absent; eyes absent; postantennal organs present; unguiculus present; anal spines minute or absent; white or yellow............*Willemia* Börner.
2. Eyes eight on each side; postantennal organs present; furcula well developed...3.
   Eyes five on each side; postantennal organs absent; unguiculus absent; furcula often more or less reduced; anal spines two, usually minute. *Xenylla* Tullberg, p. 495.
3. Postantennal organs with four to seven peripheral tubercles. *Achorutes* Templeton, 4.
   Postantennal organs each with a single large elongate suboval tubercle; unguiculus absent; anal spines absent...................*Beckerella* Linnaniemi.
4. Unguiculus present...............................*Achorutes* Templeton, p. 478.
   Unguiculus absent..........................Subgenus *Schöttella* Schäffer, p. 494.

Genus ACHORUTES Templeton.

Achorutes TEMPLETON, 1835.—TULLBERG, 1872.
Hypogastrura BOURLET, 1842.—BÖRNER, 1906.

Eyes eight on each side of the head. Postantennal organs each with four (seldom more) peripheral tubercles. Antennae cylindrical, four-segmented. Mouth parts mandibulate; mandibles with a well-developed subapical many-toothed molar surface. Unguiculus present (except in subgenus *Schöttella*). Clavate tenent hairs present in most species. Furcula and tenaculum present. Anal spines present (except in some species of *Schöttella*), usually two. Integument tuberculate.

The genus *Hypogastrura* Bourlet, revived by Börner ('06, p. 156) and adopted by some writers, is invalid. In 1839 Bourlet made the genus *Hypogastrura* to receive a single species, *Podura aquatica* Linnaeus. In 1842 he used the same name in a new sense for species of *Achorutes*. *Hypogastrura* is a homonym, and the type of *Hypogastrura* is not *Achorutes murorum* but *Podura aquatica* Linnaeus.

KEY TO SPECIES OF ACHORUTES.

1. Dentes with several or many large dorsal teeth; color dark blue................2.
Dentes without dorsal teeth..3.
2. Anal spines minute...*socialis*, p. 484.
Anal spines long...*harveyi*, p. 486.
3. One long tenent hair, usually but not always clavate..........................4.
Two or three long clavate tenent hairs...12.
4. Anal spines present...5.
Anal spines absent; yellow mottled with brown.................*tigrina*, p. 480.
5. Body with stout capitate hairs; color dark blue.............*packardi*, p. 482.
Body without capitate hairs..6.
6. Anal spines long, at least three-quarters as long as hind ungues................7.
Anal spines short, one-third to one-half as long as hind ungues................10.
7. Outer lamella of mucro with a large subtriangular lobe (fig. 111)................8.
Outer lamella of mucro with a small subtriangular lobe (fig. 92) or with entire margin...9.
8. Anal spines long; at least as long as the hind ungues; lobe of outer lamella not thickened distally; antennae with a large eversible sac between the third and fourth segments...*armatus*, p. 491.
Anal spines three-quarters as long as hind ungues; lobe of outer lamella terminating distally in a large tooth-like thickening; no eversible antennal sac...*pseudarmatus*, p. 490.
9. Outer lamella of mucro with a small subtriangular lobe; anal spines equal to, or longer than, hind ungues...*guthriei*, p. 489.
Outer lamella of mucro with entire dorsal margin; anal spines three-quarters as long as hind ungues.............................*packardi*, var. *dentatus*, p. 483.
10. Anal spines one-half as long as hind ungues; mucro not hooked apically; dark blue...*copiosus*, p. 480.
Anal spines less than one-half as long as hind ungues; mucro hooked apically..11.
11. Color dark blue..*maturus*, p. 481.
Cream yellow, marked with pale purple..........................*brevispinus*, p. 482.
12. Outer lamella of mucro large (fig. 86); ventral margin of mucro rounded distally..*viaticus*, p. 489.
Outer lamella small, narrow; ventral margin of mucro almost straight........13.
13. Anal spines minute, less than one-fourth as long as hind ungues *macgillivrayi*, p. 488.
Anal spines one-third to one-half as long as hind ungues........................14.
14. Mucro with upturned apex...*tullbergi*, p. 487.
Mucro straight apically..*humi*, p. 487.

Achorutes longispinus MacGillivray ('93, p. 315) is an *Isotoma*, as I have found from an examination of four of the cotypes which were kindly sent to me by the author of the species.

ACHORUTES TIGRINA Harvey.

Plate 8, figs. 7–9.

Achorutes tigrina HARVEY, 1900.

"The ground color straw yellow mottled with patches of deep brown; the sutures show the ground color and give a transversely banded appearance; the dark markings on the dorsum arranged in three interrupted longitudinal bands, one median and the others lateral, alternating with the ground color; these longitudinal stripes show more plainly on the middle of the body, where each segment bears about three blotches in each band." Eye-patches approximate; eyes eight on each side (fig. 7). Postantennal organ (see beyond). Antennae as long as the head; segments as 3:8:6:9; second and third subcylindrical; fourth rounded conical. Body slender, subcylindrical; abdomen scarcely dilated. Ungues (fig. 8) broad, slightly curving, with inner margin unidentate beyond the middle. Unguiculus two-thirds as long as unguis on first and second pairs, one-half as long on third pair; with small semi-elliptical lamella preceded by a rounded basal lobe, and with setaceously produced outer margin; claws minutely tuberculate. One long tenent hair, minutely knobbed. Furcula not quite extending to the second abdominal segment; manubrium stout, trapezoidal; dentes (fig. 9) obese, with apex one-third as broad as the base; mucrones (fig. 9) one-third dentes in length, simple, rounded apically. Anal spines absent. Body thickly clothed with long stiff setae and long curving hairs. Length, 1.3 mm.

The postantennal organs, as I found them, were simple circular organs, as in figure 7. I examined them in but one specimen, however, having only three of Harvey's cotypes at my disposal, so I can not say whether they were abnormal in this specimen or not.

This species was described originally from eight cotypes, found on bark in the woods at Poronal, Maine, in May, by O. O. Stover.

ACHORUTES COPIOSUS, new species.

Plate 8, figs. 10–14.

Achorutes schneideri SCHÄFFER, GUTHRIE, 1903.

Blackish blue. Eyes eight on each side. Antennae slightly longer than the head; fourth segment about twice as long as the third. Unguis (fig. 10) slender, unidentate about one-third from apex. Unguiculus more than half as long as unguis, with rounded basal lamella and with distal half acuminate. Claws minutely tuberculate.

Tenent hair single, knobbed, unusually long, about one and one-half times as long as the unguis. Dentes gradually tapering. Mucrones two-sevenths as long as dentes, minutely tuberculate, in form as in figures 11 and 12. Anal spines (fig. 13) two, half as long as hind ungues, curving, on prominent contiguous papillae, which are shorter than the spines. Clothing mostly of short curving setae, as in figure 14. Length, 1.6 mm. in specimens studied by me; 2.25 mm. according to Guthrie.

The present description and figures are from 13 cotypes (slide No. 53*a*, Univ. of Minn.), collected by Guthrie, May 2, 1899, in Minnesota.

This species is not the European *A. schneideri* Schäffer, as I have learned by comparing it with seven specimens of the latter sent to me by Doctor Schäffer. In *schneideri* (synonymous with *sahlbergi* Reuter) the anal spines are straight and not longer than the papillae, and the mucrones and unguiculi are different in form from those of this species.

Guthrie found this form to be abundant in moist situations, as under boards and in crevices in a living tree where the sap was exuding.

The cotypes are in the collection of the University of Minnesota.

ACHORUTES MATURUS, new species.

Plate 8, figs. 15–21.

Achorutes schötti REUTER, GUTHRIE, 1903.

Dark blue, grayish blue, or grayish, with round or oval spots made by hypodermal nuclei. Eyes eight on each side. Postantennal organs (fig. 15) with four peripheral tubercles and a large oval "Nebenhöcker." Antennae shorter than the head, with segments as 11:14:17:26, in relative lengths. Sense-organ of third antennal segment as in figure 16. Body stout. Unguis (fig. 17) stout, unidentate beyond the middle of the inner margin. Unguiculus about half as long as unguis, lanceolate, acuminate. One long knobbed tenent hair, often extending as far as the apex of the unguis. Dentes stout, slightly tapering, not swollen apically and without large dorsal tubercles. Mucro (figs. 18, 19) two-fifths dens in length, elongate-triangular, with outer lamella terminating before the apex, which is rounded and upturned. Anal spines (fig. 20) two, slightly curving, small, less than one-third the hind ungues in length. Clothing (fig, 21) sparse, of short stiff setae. Length, 1 mm.

This species resembles the European *manubrialis* Tullberg (*schötti* Reuter), for which Guthrie mistook it. I have compared two of Guthrie's specimens with four of *manubrialis*, which I received from Doctor Schäffer, and find that *maturus* differs in having no coarse dorsal tubercles on the dentes, in having relatively longer dentes, curving anal spines, and another type of clothing.

Illinois.—Urbana, March 30, April 12, 30, May 2, 7, abundant in woodlands, in humus, and on agarics.

Minnesota.—April 8, J. E. Guthrie (Univ. of Minn.).

The cotypes are in the collection of the University of Minnesota.

ACHORUTES BREVISPINUS Harvey.

Plate 9, figs. 22–28.

Achorutes brevispinus HARVEY, 1893.

Cream yellow above, with pale purple patches and streaks; dorsum with several interrupted stripes. Eye patches reniform. Eyes eight on each side. Postantennal organs (figs. 22, 23) large, with four or five peripheral tubercles. Antennae subequal to head in length; segments as 4:5:6:8 in relative lengths; second and third segments slightly expanding; fourth ovate. Body subfusiform. Ungues (fig. 24) slender, curving, unidentate two-fifths from the apex. Unguiculus long, extending beyond the middle of the unguis, slender, gradually tapering from base to apex. One clavate tenent hair. Manubrium as long as the remainder of the furcula. Dentes slender, tapering. Mucro (figs. 25, 26) almost one-half as long as dens, lamellate, with a blunt apical hook and a subapical dorsal excavation. Anal spines (fig. 27) two-fifths as long as hind ungues, slender, feebly curving, on small, slightly separated papillae. Clothing (fig. 28) of sparse short curving denticulate setae, with a few longer setae on the posterior part of the abdomen. Maximum length, 2.5 mm.

Redescribed from Harvey's cotypes.

This species was found to be exceedingly abundant during the winter in celery, stored in a cellar; it was also noticed out-of-doors in autumn in potato hills.

Orono, Maine, February, March, April 22, November, December, F. L. Harvey.

ACHORUTES PACKARDI Folsom.

Plate 9, figs. 29–33.

Achorutes nivicola PACKARD, 1873.—LINTNER, 1885.—MACGILLIVRAY, 1891.—HARVEY, 1893.
Schoturus nivicola LINTNER, 1896.
Achorutes packardi FOLSOM, 1902*a*.

Dark indigo blue throughout. Eyes eight on each side. Postantennal organs (fig. 29) with four peripheral tubercles. Antennae shorter than the head, with segments as 5:8:7:10. Ungues (fig. 30) stout, untoothed. Unguiculi of hind feet two-fifths as long as the ungues, slender, with apical half acuminate; of the other feet, one-fourth as long as the ungues and small. Tenent hair stout, exceeding the unguis in length. Dens (fig. 31) without dorsal teeth. Mucro (fig. 31) one-fifth as long as dens, in form like the end of a canoe, with apex often upturned. Anal spines (fig. 32) two, almost as long as the ungues, curving, on large contiguous papillae. Clothing (fig. 33) of many stout surving serrate setae of moderate length and fewer long stiff capitate setae, more or less serrate. Maximum length, 2.5 mm.

This is the species that Packard redescribed as *nivicola* Fitch. Packard's specimens are not in the Museum of Comparative Zoölogy, with the rest of his Essex County material, but I have his original drawings, which leave no doubt as to what species he regarded as *nivicola*. Harvey and Lintner depended upon Packard's account of *nivicola*, and the specimens to which they applied that name are, indeed, the same species that Packard had in hand; this I have learned from an examination of the identical specimens that Harvey and Lintner used in preparing the papers mentioned above in the synonymy.

This species is frequently found on red maple trees, crawling on the trunk or remaining under the bark or in crevices, especially about the base of a tree. I have occasionally found it under the loose bark of pine, oak, and apple trees, or about the roots; or clustered under moss on a stone. In Massachusetts full-grown individuals occur from mid-April until the middle of June; a second brood begins to appear late in June and has disappeared by the last of August. I have twice (April 22, 29) found abundant eggs of this species under the loose moist bark of red maple roots, protected by the sod; they were pale yellow, spherical, 135 micra in diameter, in irregular masses, and hatched in a little less than one month.

Maine.—Orono, February, March 10, 15, May, F. L. Harvey.

Massachusetts.—Cambridge, April 17, 22, 29, May 2, 4, June 11. Arlington, April 17. Lexington, May 10, 11.

New York.—Ithaca, January 30, J. H. Comstock; February 24, A. D. MacGillivray. Stockport, April 18, Mrs. J. A. Lathrop. Ghent, April 13, E. C. Powell (N. Y. State Coll.). Monsey, March 21, H. Glasgow.

Pennsylvania.—Harrisburg, March 23, H. A. Surface.

Maryland.—Newark, January 24, Beckwith (N. Y. State Coll.).

Ohio.—Salem, March 21, A. D. MacGillivray.

Illinois.—Urbana, April 9, 11, 25. Lagrange, November 6, J. J. Davis.

Canada.—Toronto, Ontario, June 26, R. J. Crew.

ACHORUTES PACKARDI Folsom, var. DENTATUS Folsom.

Plate 10, figs. 34–41.

Achorutes packardi, var. *dentatus* Folsom, 1902*a*.
Achorutes lapponicus Axelson, 1902.
Hypogastrura lapponica (Axelson) Linnaniemi, 1912.

In this variety all the ungues (fig. 34) are unidentate; the mucrones are one-fourth as long as the dentes, and in form as in figures

35 to 39; the erect capitate setae characteristic of typical *packardi* are absent, though some of the setae on the posterior part of the abdomen may be obscurely capitate. In other respects the variety agrees with the typical form.

I have found this variety under the loose bark of pine, red maple, and oak trees, especially at the base of the roots; and it occurs sometimes on snow. In Massachusetts it has at least three broods, which mature at intervals of six or seven weeks.

Dentatus is a seasonal variety of *packardi*. I have raised the latter from eggs of the former, which hatched May 20 (Massachusetts).

I agree with Linnaniemi ('12, p. 32) that his *A. lapponicus* of Finland and Sweden is probably this variety *dentatus*. The distal tibiotarsal hairs are often feebly clavate in *dentatus* and apparently strongly clavate in *lapponicus*. The name *dentatus* (March, 1902) antedates *lapponicus* ("Mitgeteilt am 5. April, 1902").

Maine.—Orono, March 10, 15, May 1, 3, F. L. Harvey.

Massachusetts.—Arlington, April 10, 13, 23, 30, May 23, September 10.

New York.—Ithaca, April 12, A. D. MacGillivray. , Ghent, April 13, E. C. Powell (N. Y. State Coll.).

Ohio.—Salem, March 18, A. D. MacGillivray.

ACHORUTES SOCIALIS Uzel.

Plate 7, fig. 1; plate 10, figs. 42–46; plate 11, figs. 47–50.

Podura nivicola FITCH, 1847.
Achorutes socialis UZEL, 1890.—SCHÖTT, 1894*a*, 1896*b*, 1902.—SCHÄFFER, 1896.—CARL, 1899, 1901.—REUTER, 1900.—ABSOLON, 1901*b*.—LIE-PETTERSEN, 1901.—KRAUSBAUER, 1902.—GUTHRIE, 1903.—WAHLGREN, 1906*b*.—(AXELSON) LINNANIEMI, 1907.
Schoturus nivicola MACGILLIVRAY, 1893*b*.—DALLA TORRE, 1895.
Achorutes diversiceps LINTNER, 1896.
Achorutes spinifer SCHÄFFER, 1896.
Achorutes nivicola FOLSOM, 1902*a*.—AXELSON, 1904.—LIE-PETTERSEN, 1907.
Hypogastrura socialis LINNANIEMI, 1912.

Dark indigo blue throughout. Eyes (fig. 42) eight on each side. Postantennal organs (fig. 43) with four peripheral tubercles. Antennae about as long as the head, with segments as 7:9:10:15; basal segment subglobose, second and third subcylindrical, fourth rounded conical. Olfactory hairs of fourth antennal segment (fig. 44) six to ten—four to eight outer and two inner. Sense-organ of third antennal segment (fig. 45) with two oblong-clavate curving processes. Body elongate, abdomen subfusiform, last segment subcylindrical. Unguis (fig. 46) slightly curving, with inner margin unidentate about one-third from the apex. Unguiculus extending about half as far as unguis, basally subovate, apically acicular. One long tenent hair with a minute knob. Distal tibiotarsal hairs apically bent and often feebly knobbed. Dentes (fig. 47) stout, subcylindrical, apically broad and rounded, bearing dorsally four to seven prominent acutely-conical teeth, besides several or many smaller pointed teeth. Mucro (figs. 47, 48) one-fourth as long as dens, inserted on inner side of apex of dens, and somewhat boat-shaped; in profile, suboblong, feebly curving, apically retuse or emarginate. Anal spines (fig. 49) two, small, conical, erect or curving slightly forward, on low, separated papillae. Clothing (fig. 50) of simple setae. Maximum length, 2 mm.

The postantennal organ rarely has five peripheral tubercles. The "Nebenhöcker" is round or rounded-triangular. The sense-organ of the third antennal segment is essentially the same in American and European specimens (compare my fig. 45 with Absolon, '01*b*, fig. 1). The "Riechzäpfchen" of the fourth antennal segment, however, are often longer and more curving than they appear in the figure given by Absolon ('01*b*, p. 583). The teeth of the dentes are modified cuticular tubercles; on the proximal side of the large teeth there are often several small teeth which merge into the minute tubercles of the integument (fig. 47). The mucro varies somewhat in form, chiefly in the depth of the apical notch, which is sometimes almost absent; in a few specimens I have seen the form of mucro represented by Schött ('94*a*, pl. 7, fig. 7), but in only a few out of many hundreds of specimens examined.

Owing to the inadequacy of Fitch's original description of *Podura nivicola* I redescribed his species in 1902. The first competent description of the species was given, however, by Uzel in 1890; hence his name *socialis* should be used instead of *nivicola*.

North American specimens agree accurately with three Swedish examples of *socialis* which were determined by Schött and sent to me by Schäffer.

I sent American specimens to Schäffer, who replied that his *Achorutes spinifer* was a color variety of *nivicola* (*socialis*).

Lintner's *diversiceps* is a synonym of *socialis* Uzel. I have studied Lintner's cotypes through the kindness of Dr. E. P. Felt.

For the loan of Guthrie's specimens of *A. socialis* I am indebted to Prof. H. F. Nachtrieb.

This is an abundant species in our forests in the winter and fore part of spring. At any time in the winter, whenever a few days of mild weather occur, the surface of the snow, often over whole acres of woodland, may be found sprinkled more or less thickly with these minute fleas, looking, at first sight, as though gunpowder had been there scattered. Hollows and holes in the snow, out of which the insects are unable to throw themselves readily, are often black with the multitudes which here become imprisoned. The hairs which clothe their bodies enable them to float buoyantly upon the surface of water without becoming wet. When the snow is melting so as to produce small rivulets coursing along the tracks of the lumberman's sleigh, these snow-fleas are often observed, floating passively in its current, in such numbers as to form continuous strings; whilst the eddies and still pools gather them in such myriads as to wholly hide the element beneath them. In the early spring the buckets and troughs of the manufacturer of maple sugar are often thronged with these insects. (Fitch.)

Achorutes socialis is a common species in most parts of Europe.

Maine.—Orono, February 18, March 6, April 15, May 6, F. L. Harvey. Norway, March 11, May 7, F. Howe, jr.

Massachusetts.—Arlington, April 12, 15. Belmont, April 19, May 5. Concord, October 16, H. B. Bigelow. Winchester, February 9, R. W. Hall. Wellesley, January 28, September 10, A. P. Morse (Cornell Univ.).

New York.—Center, J. A. Lintner. Karner, April 26, J. A. Lintner (N. Y. State Coll.). Otto, J. H. Comstock.

Pennsylvania.—Osceola, A. D. MacGillivray.

Michigan.—Agricultural College, May, R. H. Pettit.

ACHORUTES HARVEYI Folsom.

Plate 11, figs. 51–58.

Achorutes harveyi Folsom, 1902*a*.
? *Achorutes frigidus* Axelson, 1905*b*.—(Axelson) Linnaniemi, 1907.
? *Hypogastrura frigida* (Axelson) Linnaniemi, 1912.

Dark indigo blue throughout. Eyes (fig. 51) eight on each side. Postantennal organs (fig. 52) smaller than the eyes, with four (sometimes five) peripheral tubercles. Antennae slightly longer than the head, with segments as 10:13:13:20; first two segments subclavate, last two subcylindrical. Olfactory hairs of fourth antennal segment. Sense-organ of third antennal segment consists of two oblong-clavate curving processes. Body elongate, abdomen subfusiform. Unguis (fig. 53) slightly curving, unidentate about one-third from the apex. Unguiculus basally suboblong, apically acuminate. One long tenent hair with bent apex. The remaining distal tibiotarsal hairs are usually bent at the tips and often minutely knobbed. Dentes (figs. 54, 55) stout, subcylindrical, apically broad and rounded, bearing dorsally two irregular rows of acutely conical teeth, usually 7 to 18 in number. Mucrones (figs. 54–56) almost one-fourth as long as dentes, similar to those of socialis in form. Anal spines (fig. 57) two, long (almost as long as the ungues), on prominent approximate papillae; beside each spine is a large hair, apically blunt or feebly knobbed. Clothing (fig. 58) of simple setae. Length, 2.6 mm.

Achorutes frigidus Axelson is closely allied to this species, with which it may prove to be synonymous.

Maine.—Orono, F. L. Harvey. Norway, February 23, F. Howe, jr.

Massachusetts.—Arlington, January 16, March 1, 10, 20, April 8, 9, 12, 30.

New York.—Ithaca, April 12, A. D. MacGillivray.

Maryland.—Annapolis, January 15, C. E. Munroe (M. C. Z.).

ACHORUTES HUMI, new species.

Plate 12, figs. 59–66.

Purplish, yellowish, or greenish above; pigment purple, ground color pale yellow; white or pale yellow beneath; antennae purple. Eye spots black, conspicuous. Eyes (fig. 59) eight on each side. Postantennal organs (fig. 60) with four subequal peripheral tubercles. Antennae slightly shorter than the head; segments as 17:17:20:30 in relative lengths. Sense-organ of third antennal segment as in figure 61. Unguis (fig. 62) stout, without teeth or feebly unidentate one-fourth from the apex. Unguiculus long (fig. 62); basal lamella suboblong; distal half acicular. Tenent hairs 3, 3, 3, knobbed and long. Rami of tenaculum tridentate. Dens three times as long as mucro, with six dorsal setae. Mucro elongate, in form as in figures 63 and 64, with semi-elliptical outer lamella, terminating before the apex. Anal spines (fig. 65) short (less than half as long as hind ungues), stout, curving, on papillae that are shorter than the spines. Clothing of short setae, stiff or curving (fig. 66), and sparse except on the posterior part of the abdomen. Length, 0.8 mm.

I have taken this species in abundance in woodlands in damp soil and among dead leaves on the ground.

Urbana, Illinois, April 19, 26, May 2.

Cotypes.—Cat. No. 19899, U.S.N.M.

ACHORUTES TULLBERGI Schäffer.

Plate 12, figs. 67–73.

Achorutes dubius TULLBERG, 1876.—UZEL, 1890.—SCHÖTT, 1894*a*.—DALLA TORRE, 1895.—SCHÄFFER, 1896.—SKORIKOW, 1900.
Achorutes dubius, var. *concolor* CARPENTER, 1900.
Achorutes tullbergi SCHÄFFER, 1900.
Achorutes tullbergi, var. *concolor* SCHÄFFER, 1900*b*.—WAHLGREN, 1907.

Uniform blackish blue. Eyes (fig. 67) eight on each side. Postantennal organs (fig. 68) with four (sometimes five) peripheral tubercles. Antennae shorter than the head; segments as 6:7:9:9 in relative lengths; sense-organ of third segment as in figure 69. Ungues (fig. 70) stout, slightly curving; inner margin unidentate one-third from apex. Unguiculi with setaceously prolonged outer margin and with the basal lamella suboblong on the second and third pairs of feet. Tenent hairs knobbed; 2, 3, 3, as a rule; occasionally 3, 3, 3, or 1, 3, 3. Mucrones (fig. 71) one-third dentes in length, elongate-cuneate, apically rounded, with narrow lamella. Anal spines (fig. 72) two, half as long as hind ungues, arcuate, on prominent contiguous papillae. Clothing (fig. 73) of sparse short curving setae, with longer setae on the posterior part of the abdomen. Length, 2 mm.

The variety *concolor* of Carpenter is pigmented uniformly; while typical *dubius* is flecked with pigment.

Specimens from Massachusetts agree in all essential respects with the original brief diagnosis by Tullberg and with the description by Carpenter, who compared his Franz-Josef specimens with Spitzbergen examples sent to him by Dr. C. Schäffer. The Massachusetts specimens belong to the variety *concolor*, but differ from Carpenter's description and figures in having stouter antennal segments, unidentate ungues and straighter mucrones. I sent some of these specimens to Schäffer, who reported that they were *dubius* Tullberg, and changed the name to *tullbergi;* the name *dubius* having been previously used by Templeton for another species of Achorutes.

I found large colonies of this species at Revere, Massachusetts, August 23 and 25, under wet boards on a salt marsh.

ACHORUTES MACGILLIVRAYI, new species.

Plate 13, figs. 74–81.

Pale mottled blue above, pale beneath; or uniform dark blue above. Eye patches oval, remote from antennae. Eyes eight on each side. Postantennal organs (figs. 74, 75) with four or five peripheral tubercles. Antennae longer than the head, with segments as 7:8:9:20 in relative lengths. Sense-organ of third antennal segment as in figure 76. Unguis (fig. 77) feebly curving, inner margin unidentate one-third from apex. Unguiculus one-half to three-fifths as long as unguis, with broad rounded basal lamella, and with apical half acuminate. Tenent hairs knobbed, 2, 3, 3 or 3, 3, 3, the middle hair larger than the other two. Dentes subcylindrical, slender, untoothed. Mucrones (fig. 78) one-fourth dentes in length, elongate-cuneate in profile, with projecting blunt apex and dorsal subapical notch. Anal spines (figs. 79, 80) two, about as long as the lamella of an unguiculus, stout, almost straight, on large contiguous papillae. Clothing (fig. 81) of sparse minute setae, with long stiff setae on the appendages and the extremity of the abdomen. Length, 1.6 mm.

This species resembles *Achorutes purpurescens* Lubbock, from which it differs chiefly in the form of the mucrones and unguiculi and in the type of clothing. *Purpurescens,* of which I have received six European specimens from Dr. Caesar Schäffer, has long stiff setae in a row across the middle of almost every body-segment which are lacking in this species.

Described from numerous cotypes collected at Ithaca, New York, by Dr. A. D. MacGillivray, after whom the species is named, and sent to me some years ago by him and also by Prof. F. L. Harvey, of Orono, Maine.

New York.—Ithaca, April 18, May 2, September 4, November 12, under damp leaves and on surface of standing water, A. D. MacGillivray.

Illinois.—Galesburg, March, on surface of lake, J. G. Needham.

Cotypes.—Cat. No. 19900, U.S.N.M.

ACHORUTES VIATICUS Tullberg.

Plate 13, figs. 82–88.

Achorutes viaticus TULLBERG, 1872, 1876.—SCHÖTT, 1891*b*, 1894*a*, 1896*a*.—REUTER, 1895.—SCHÄFFER, 1896, 1897, 1900*b*.—LIE-PETTERSEN, 1897, 1898.—SCHERBAKOV, 1898.—CARL, 1899, 1901.—CARPENTER and EVANS, 1899.—WAHLGREN, 1899*a*, 1900*a*.—SKORIKOW, 1900.—WILLEM, 1900.—BÖRNER, 1901*d*.—KRAUSBAUER, 1901.—AXELSON, 1905*a*, 1905*b*, 1906.—(AXELSON) LINNANIEMI, 1907.—SHOEBOTHAM, 1914.

Achorutes humicola MEINERT, 1896.

Hypogastrura viatica (AXELSON) LINNANIEMI, 1911, 1912.

Uniform dark blue. Eyes (fig. 82), eight on each side. Postantennal organs (fig. 83) small, scarcely larger than one of the eyes, with four or five peripheral tubercles. Antennae shorter than the head, with segments as 6:5:7:7 in relative lengths. Fourth antennal segment with four or five olfactory hairs. Abdomen slightly dilated. Unguis (fig. 84) long, slender, feebly curving, minutely unidentate two-fifths from the apex. Unguiculus half as long as unguis; proximal half with a broad suboblong lamella; distal half acicular. Tenent hairs clavate; 3, 3, 3 or sometimes 2, 3, 3; the middle hair longer than the other two. Rami of tenaculum quadridentate. Dentes three times as long as mucrones. Mucrones (figs. 85, 86) subovate in lateral aspect, with apical third falcate and outer lamella proximally broad and rounded, distally excavate. Anal spines (fig. 87) one-fourth to two-fifths as long as hind ungues, curving, on prominent adjacent papillae, which are about one-third as long as the spines. Clothing of numerous setae (fig. 88), short and curving, or longer, stout and stiff; the latter often feebly denticulate. Length, 2 mm.

The tooth of the unguis is often absent. The outer lamella of the mucro varies considerably in form.

This species was reported from California by Schött) '91*b*, p. 23; '96*a*, p. 186), who said that the specimens from that State agreed fully with those of Sweden. I have never seen North American specimens of this species; hence have made my description and figures from 16 European examples that I have received from Dr. C. Schäffer.

Achorutes viaticus is a widely distributed species, occurring throughout Europe, in Siberia, Greenland, and other Arctic localities, North America, Argentina, and subantarctic South America.

California.—San Francisco, B. Eisen (Cal. Acad. Sci.).

ACHORUTES GUTHRIEI, new species.

Plate 14, figs. 89–94.

Achorutes longispinus TULLBERG, GUTHRIE, 1903.

Dark blue. Eyes, eight on each side. Postantennal organs (fig. 89) with four peripheral tubercules. Antennae shorter than the head. Sense organ of third antennal segment as in figure 90.

Unguis (fig. 91) unidentate near the middle of the inner margin. Unguiculus about half as long as unguis, with rounded or suboblong basal lamella and with apical two-thirds tapering to a point. Tenent hair single, unknobbed. Mucrones two-fifths as long as dentes, almost as long as hind ungues, somewhat slipper-shaped, the outer lamella having a prominent obtuse angle, as in figure 92. Anal spines (fig. 93) long, exceeding the hind ungues in length, slender, curving, separated basally. Clothing (fig. 94) of short curving setae and short stiff hairs. Length, 1 mm.

This species referred to *A. longispinus* Tullberg by Guthrie, is distinct from that species, as I have found by comparing 20 of Guthrie's specimens with 6 Spitzbergen examples of *longispinus* given to me by Doctor Schäffer. In *longispinus* the mucrones are spoon-shaped and tuberculate, and the body setae differ from those of this species in form, number, and arrangement.

A. guthriei is allied to *A. bengtssoni* Ågren ('04, p. 2) in the form of the mucrones; but the latter species is olive brown, with short anal spines, apically swollen dentes, eversible sac between the third and fourth antennal segments, and other characters different from those of this species.

A. guthriei is also related to but evidently distinct from *A. sigillatus* Uzel ('90, p. 70).

The preceding description is based on 20 of Guthrie's specimens (slide No. 135*d*, Univ. of Minn.), collected by him August 23, 1899, at Lake Pepin, Minn., where they occurred by hundreds on the surface of a pool of water.

The cotypes of *A. guthriei* are in the collection of the University of Minnesota.

ACHORUTES PSEUDARMATUS, new species.

Plate 14, figs. 95–100; plate 15, figs. 101–103.

Black or mottled dark blue. Eyes, eight on each side (fig. 95). Postantennal organs (fig. 95) with four peripheral tubercles and a conspicuous round "Nebenhöcker"; the two anterior peripheral tubercles are twice as long as the posterior ones. Antennae subequal to head in length. Olfactory hairs of fourth antennal segment (fig. 96) seven in number—two outer, two inner, and three dorsal. Sense organ of third antennal segment as in figure 97. There is no eversible sac between the third and fourth antennal segments. Unguis (fig. 98) long, slender, slightly curving, unidentate near the middle of the inner margin; lateral margins each unidentate one-third from the base. Unguiculus extending half as far as the unguis, with rounded basal lamella and acuminate apical half. One long tenent hair, feebly clavate. Dentes stout, apically rounded. Mucrones (figs. 99, 100) three-fifths as long as dentes, in form much like those of *armatus*, but with the outer lamella terminating distally in a large toothlike thickening. Anal spines (figs. 101, 102) long, but shorter than hind ungues, slightly curving, on short contiguous papillae, which are one-seventh as long as the spines. Clothing (fig. 103) of minute curving setae with one transverse row of long stiff hairs on each of the first six segments and many such hairs on the last three segments; the long hairs being often minutely serrate. Length, 1.6 mm.

This species might easily be mistaken for *armatus* Nicolet, at first glance, on account of the general similarity in mucrones, claws, and anal spines. It differs from *armatus,* however, in the following particulars: the toothlike thickening of the outer lamella of the mucro; anal spines shorter than the mucrones; anal papillae short in relation to the spines; dentes rounded apically; eversible antennal sac absent; character of antennal sense organs; form of postantennal organs; form of basal lamella of unguiculus; type of clothing. In *armatus,* it should be added, the infra-anal lobes are small; in *pseudarmatus* they are large (compare figs. 101 and 114).

California.—Claremont, Gillett.

British Columbia.—Kaslo, J. W. Cockle.

Cotypes.—Cat. No. 19901, U.S.N.M.

ACHORUTES ARMATUS Nicolet.

Plate 7, fig. 2; plate 15, figs. 104–113; plate 16, figs. 114–117.

Podura armata, NICOLET, 1841.

Achorutes armatus GERVAIS, 1844.—NICOLET, 1847.—LUBBOCK, 1868, 1873.—TULLBERG, 1871, 1872, 1876.—PARONA, 1879, 1882, 1888, 1895.—TÖMÖSVÁRY, 1883.—OUDEMANS, 1890.—UZEL, 1890, 1891.—MACGILLIVRAY, 1891.—SCHÖTT, 1891*b*, 1894*a*, 1896*a*, 1902.—MONIEZ, 1894.—DALLA TORRE, 1895.—REUTER, 1895.—MEINERT, 1896.—SCHÄFFER, 1896, 1897, 1900*a*, 1900*b*.—CARPENTER, 1897.—LIE-PETTERSEN, 1897, 1898.—POPPE and SCHÄFFER, 1897.—SCHERBAKOV, 1898, 1899.—CARL, 1899, 1901.—CARPENTER and EVANS, 1899.—WAHLGREN, 1900*a*.—BÖRNER, 1901*d*.—KRAUSBAUER, 1901.—WILLEM, 1902.—ÅGREN, 1903, 1904.—AXELSON, 1905*a*, 1905*b*, 1906.—(AXELSON) LINNANIEMI, 1907, 1909.—COLLINGE and SHOEBOTHAM, 1910.—IMMS, 1912.—SHOEBOTHAM, 1914.

Achorutes boletivorus PACKARD, 1873.—MACGILLIVRAY, 1891.—DALLA TORRE, 1895.—GUTHRIE, 1903.

Achorutes marmoratus PACKARD, 1873.—MACGILLIVRAY, 1891.—HARVEY, 1893.

Achorutes texensis PACKARD, 1873.—MACGILLIVRAY, 1891.—DALLA TORRE, 1895.

Achorutes pratorum PACKARD, 1873.—MACGILLIVRAY, 1891.—DALLA TORRE, 1895.

Hypogastrura armata (AXELSON) LINNANIEMI, 1911, 1912.—CAROLI, 1914.

Very variable in coloration. General color vinaceous, pale violet, greenish gray, or dark blue. One variety is canary yellow marbled with lavender, with two dorsal stripes of the latter color. The dorsum is commonly mottled or marbled, and the pleura and sternum pale yellow with round spots made by hypodermal nuclei. A large interocular spot occurs. Ocular patches conspicuous, black, hemispherical. Eyes eight on each side. Postantennal organ (figs. 104,

105) large, with four unequal peripheral tubercles. Antennae shorter than the head; segments in relative lengths as 5:4:5:6; fourth segment with seven olfactory hairs: two outer, two inner, and three dorsal (fig. 106). Sense-organ of third segment as in figure 107. Between the third and fourth antennal segments is a large ventral eversible bilobed sac (fig. 108). Body stout; abdomen feebly dilated. Unguis (fig. 109) long, slender, slightly curving, unidentate near the middle of the inner margin; lateral margins each unidentate one-fourth from the base (fig. 110). Unguiculus with suboblong basal lamella and setaceous apex, extending about as far as the tooth of the opposite claw. One long tenent hair, unknobbed. Dentes stout, subcylindrical. Mucrones (figs. 111–113) half as long as dentes, apically rounded; inner lamella narrow, simple; outer lamella with a large subtriangular dorsal lobe. Anal spines (figs. 114–116) long, a little longer than the ungues in adult specimens, slender, curving, on large contiguous papillae, which are one-third to one-half as long as the spines. Clothing (fig. 117) dense, consisting of abundant short curving setae and numerous long hairs and setae, which are frequently serrate. Length, 1.5 mm.

In small specimens the anal spines are shorter than the ungues and straight. One of my specimens had three fully developed anal spines, there being an accessory median spine in front of the other two; this variation occurs in several species of the genus.

The two following varieties have been found in Europe but not as yet in this country: var. *inermis* Axelson ('05*b*), in which anal spines and papillae are absent; and var. *cuspidatus* Axelson ('05*b*), in which the seta of the unguiculus extends almost beyond the unguis and is bent distally.

Specimens from the United States agree with European examples, as both Dr. Schäffer and myself have found.

The cotypes of *Achorutes boletivorus* Packard ('73) in the Museum of Comparative Zoölogy, Cambridge, Massachusetts, are *A. armatus* Nicolet. Those that I studied there were labeled "Brunswick, Me., Sept. 10;" the specimens recorded by Packard from Salem, Massachusetts, being absent from the collection.

The cotypes of *Achorutes marmoratus* Packard ('73) were also missing; but Packard's description of this species evidently applies to the lilac-colored variety of *A. armatus* that I used to find in abundance in eastern Massachusetts.

Packard's ('73) description of *Achorutes texensis* also applies to *A. armatus* so far as it goes. The cotypes of *texensis* consist, however, of two specimens of *armatus* and four of another species of *Achorutes*, short-spined and apparently undescribed, which can not be fully described at present without sacrificing some of the cotypes. I hope to get some more specimens of this species from Texas.

Packard's ('73) *Achorutes pratorum* is simply a color variety of *armatus*, as I have found by an examination of his cotypes from Orono, Maine, those from Brunswick being absent from the collection in Cambridge, Massachusetts.

The species referred to *Achorutes boletivorus* Packard by Guthrie ('03) is *armatus*, as is evident from his description and from some of his specimens that I have studied.

Achorutes armatus, one of the most abundant species of its genus, occurs in large colonies in a great variety of situations: under the loose moist bark of logs, on damp soil under wood or dead leaves, underground among the roots of grasses or other plants, in moss, on pools of fresh water. This species is the one commonly found on fungi, particularly agarics, though it occurs on *Boletus*, *Polyporus*, *Morchella*, and other genera as well.

In Massachusetts there are three annual generations and possibly four. During one season I followed the development of three successive colonies in the same spot (under the bark of an elm log); they matured, respectively, late in May, early in July, and late in August, at intervals of about six weeks. The species may be found, however, in all stages of its growth, at any time from April to October, in Massachusetts. There it passes the winter in the egg.

Achorutes armatus is one of the most widely distributed species of Collembola. It occurs in all parts of Europe, in Siberia, Spitzbergen, Greenland, northern Africa (Tripoli), Sumatra, Ceylon, New Zealand, Brazil, Paraguay, Uruguay, Chile, and doubtless throughout the United States.

Maine.—Brunswick, September 10, A. S. Packard, jr. (M. C. Z.). Orono, July, A. S. Packard, jr. (M. C. Z.). Orono, April, May, June, September, F. L. Harvey.

New Hampshire.—Franconia, Mrs. A. T. Slosson.

Massachusetts.—Arlington, April 12, June, August 2, September 9, 19. Cambridge, March 8, 15, 23 (in a greenhouse on those dates), May 2, 4, 7, 15, June 1, 8, 11, 16, July 16, August 21, 28, September 11. Lexington, May 10, September 18. Waltham, May 3, September 6.

New York.—Ithaca, April 14, A. D. MacGillivray. Varna, March 27, N. Banks.

Pennsylvania.—Harrisburg, H. A. Surface.

Ohio.—Salem, March 21, A. D. MacGillivray. Salineville, February 22, A. D. MacGillivray. Yellow Springs, August 20.

Illinois.—Urbana, April 13, 30, July 16, August 1, October 15. White Heath, May 8.

Missouri—Columbia, February, C. R. Crosby. Olden, April 5, E. P. Taylor.

Minnesota.—J. E. Guthrie (Univ. Minn.).

Colorado.—Fort Collins, June 10, C. F. Baker.

California.—L. M. Bremner (Stanford Univ.). Claremont, February 13, E. O. Essig. Berkeley, G. Eisen (Cal. Acad. Sci.).

Texas.—Waco, G. W. Belfrage (M. C. Z.).

Canada.—Arnprior, Ontario, September, C. MacNamara.

Cuba.—Santiago de las Vegas, W. T. Horne.

Subgenus **SCHÖTTELLA** Schäffer.

Schöttella Schäffer, 1896.
Schöttella Börner, 1901*d*.

KEY TO SPECIES OF SCHÖTTELLA.

Anal spines one-fourth as long as hind ungues; ungues unidentate; tenent hairs 3, 4, 4. *uniunguiculatus*, p. 494.
Anal spines minute; ungues untoothed; tenent hairs 2, 2, 2.........*glasgowi*, p. 494.

ACHORUTES (SCHÖTTELLA) GLASGOWI, new species.

Plate 16, figs. 118–126.

Dark blue. Eyes, eight on each side. Postantennal organs (fig. 118) with four peripheral lobes, confluent basally. Antennae cylindrical, subequal to the head in length; segments in relative lengths as 7:10:12:15. Olfactory hairs of fourth antennal segment (fig. 119) seven in number: three outer, three inner, and one dorsal. Sense-organ of third antennal segment as in figure 120. Unguis (fig. 121) stout, feebly curving; inner margin untoothed; lateral margins each unidentate two-thirds from the base. Unguiculus absent, represented by a minute setaceous projection. Tenent hairs two, long, knobbed. Dentes with four dorsal setae (fig. 122). Mucrones (figs. 123, 124) five-sevenths as long as dentes, simple, gradually tapering. Anal spines (fig. 125) two, minute, conical, separated, on minute papillae. Clothing (fig. 126) of stout curving setae, the larger of which are feebly serrate. Length, 1 mm.

Blauvelt, New York, March 17, May 13, 1914. Taken from old mines of *Agrilus sinuatus* in pear, by Dr. Hugh Glasgow, after whom the species is named.

Cotypes.—Cat. No. 19902, U.S.N.M.

ACHORUTES (SCHÖTTELLA) UNIUNGUICULATUS Tullberg.

Plate 17, figs. 127–136.

Achorutes ununguiculatus Tullberg, 1869, 1871, 1872.—Schött, 1894.
Achorutes uniunguiculatus Meinert, 1896.—(Axelson) Linnaniemi, 1907.
Schöttella uniunguiculata Schäffer, 1896, 1900*a*, 1900*b*.—Krausbauer, 1901.
Schöttella ununguiculata Scherbakov, 1898.
Achorutes (*Schöttella*) *uniunguiculatus* Axelson, 1905.
Hypogastrura (*Schöttella*) *ununguiculata* (Axelson) Linnaniemi, 1912.

Dark blue. Eyes (fig. 127), eight on each side. Postantennal organ (fig. 128) with four peripheral lobes, which are hemispherical, subequal, and basally confluent, the organ being smaller than one of the eyes. Antennae shorter than the head; first three segments subequal in length. Fourth antennal segment with five short stout olfactory hairs; three outer and two inner. Sense-organ of third antennal segment as in figure 129. Unguis (fig. 130) stout, feebly curving, unidentate. Tenent hairs 3, 4, 4, knobbed. Rami of tenaculum tridentate. Dens (fig. 131) with five setae. Mucro (figs. 132, 133) three-fifths as long as dens, minutely tuberculate, elongate-triangular, apically projecting and rounded, with a prominent ventral lobe about one-third from the base. Anal spines (figs. 134, 135) two, small (one-fourth as long as hind unguis), conical, curving forward, on separated papillae, which are longer than the spines. Clothing (fig. 136) of sparse short curving setae. Length, 1.3 mm.

On one specimen the left postantennal organ showed five peripheral lobes, an abnormal condition.

I sent specimens of this form to Walter M. Linnaniemi, of Finland, who replied that they agreed in all essential characters with the European *Schöttella uniunguiculata*, the only difference being that the cuticular tubercles seemed to be somewhat larger in our specimens than in his. He kindly sent me a European example of the species, from which I was able to confirm my determination of the American form.

I have found this species in large colonies at the base of apple, maple, and hackberry trees.

Illinois.—Urbana, April 16, May, October 6. Savoy, October 26.

Genus XENYLLA Tullberg.

Xenylla Tullberg, 1869.

Eyes five on each side. Postantennal organ absent. Unguiculus absent. Furcula small, not reaching the ventral tube. Dens and mucro confluent in some species. Anal spines two, small; present in most species.

KEY TO SPECIES OF XENYLLA.

Dens and mucro confluent .... *maritima*, p. 498.
Dens and mucro demarcated by an articulation.
    Apex of mucro simple, not strongly hooked.
        Anal spines large, one-fourth as long as hind unguis .... *baconae*, p. 496.
        Anal spines minute.
            Lamella of mucro broad (fig. 154); unguiculus represented by a rounded tubercle .... *welchi*, p. 497.
            Lamella of mucro narrow (fig. 141); vestige of unguiculus absent .... *humicola*, p. 496.
    Apex of mucro strongly hooked (fig. 161) .... *gracilis*, p. 497.

XENYLLA HUMICOLA (O. Fabricius) Tullberg.

Plate 17, figs, 137–142.

Podura humicola O. Fabricius, 1780.
Achorutes humicola Lubbock, 1873.
Xenylla humicola Tullberg, 1876.—MacGillivray, 1891.—Dalla Torre, 1895.— Reuter, 1895.—Schäffer, 1896, 1900*b*.—Carpenter and Evans, 1899.—Skorikow, 1900.—Wahlgren, 1900*a*, 1900*b*.—Krausbauer, 1901.—Ågren, 1903.—Davenport, 1903.—Axelson, 1905, 1906.—(Axelson) Linnaniemi, 1907, 1909, 1911, 1912.
Xenylla maritima Meinert, 1896.

Dark blue. Eyes five on each side (fig. 137). Antennae slightly shorter than the head. Fourth antennal segment with four or five olfactory hairs—three or four lateral and one dorsal. Unguis (fig. 138) curving, with inner margin unidentate one-third from apex. Tenent hairs two, knobbed. Tenaculum tridentate on each branch. Manubrium with a deep median-longitudinal ventral furrow. Dens a little longer than mucro, with two dorsal setae (fig. 139). Mucro clearly articulated with dens, slightly longer than hind unguis, gradually tapering (figs. 140, 141), apically rounded, with a narrow lamella terminating before the apex, and with a sharp ventral incision about one-third from the base. Anal spines two (fig. 142), minute, conical, straight, on minute papillae separated from each other. Clothing of sparse short curved setae, with a few longer bristles, some of the larger setae being denticulate. Maximum length, 1.5 mm. (2 mm., Schäffer).

The North American specimens that I have studied happened to be somewhat smaller than European examples, of which I have received 27 from Doctor Schäffer, but agreed with them in every other respect.

Massachusetts.—Revere, August 23, abundant under a board on a salt marsh.

New York.—Cold Spring Harbor, Long Island, C. B. Davenport.

Ontario, Canada.—St. Thomas, August; Toronto, December (Div. Ent., Ottawa).

XENYLLA BACONAE, new species.

Plate 18, figs. 143–149.

Blackish blue; antennae, legs, and furcula violet. Eyes five on each side. Antennae subequal to head in length. Sense-organ of third antennal segment as in figure 143. Unguis (fig. 144) slender, untoothed. Tenent hairs two, knobbed, extending almost to the apex of the unguis. Furcula not extending to the apex of the abdomen. Dens and mucro clearly demarcated by an articulation (fig. 145). Dens with two dorsal setae. Mucro (fig. 146) four-fifths as long as dens, subequal to hind unguis in length, gradually tapering, apically rounded, with a sharp ventral incision one-third from the base, and without a lamella. Anal spines (fig. 147, 148) two, minute, about one-fourth as long as hind unguis, feebly curving forward, on low separated papillae. Clothing (fig. 149) of sparse short curving setae with fewer longer and stiff setae, the largest setae often being minutely serrate. Length, 1.5 mm.

California.—Claremont, in great numbers on pools of water in a newly plowed field after a rainstorm, Gertrude A. Bacon, after whom the species is named.

Cotypes.—Cat. No. 19903, U.S.N.M.

XENYLLA WELCHI, new species.

Plate 18, figs. 150–157.

Pale violet or grayish; pigment mottled. Eyes five on each side. Antennae slightly shorter than the head. Sense-organ of third antennal segment as in figure 150. Unguis (fig. 151) unidentate, minutely tuberculate. Unguiculus represented by a rounded tubercle. Tenent hairs 1, 2, 2, knobbed. Rami of tenaculum tridentate. Dens and mucro demarcated by an articulation (figs. 152, 153); dens with two setae. Mucro (figs. 153, 154) three-fifths as long as dens, distally produced and curving, apically rounded; inner lamella broad, terminating before the apex, minutely tuberculate. Anal spines (figs. 155, 156) two, minute, separated, curving slightly forward. Clothing (fig. 157) of sparse short curving setae. Length, 0.9 mm.

There is some variation in the form of the mucro, as will be seen from figures 153 and 154; furthermore, the tooth of the unguis is sometimes absent.

Manhattan, Kansas, January 4, in enormous numbers on mushroom beds in a greenhouse. Collected by Dr. P. S. Welch, after whom the species is named.

Walnut, Kansas, in immense numbers on the ground, E. P. Taylor.

Chicago, Illinois, August 14, on walls of carnation house, J. J. Davis.

Cotypes.—Cat. No. 19904, U.S.N.M.

XENYLLA GRACILIS Guthrie.

Plate 19, figs. 158–161.

Xenylla gracilis GUTHRIE, 1903.

"Rather dark blue above, paler beneath. Body slender, fusiform, head narrow in front, becoming broader between the eyes and then narrowing again. Thorax narrower than the head. Abdomen gradually broadening posteriorly till the fourth segment, after that narrowing rather abruptly, the fifth and sixth segments being much narrower. The sixth is blunt on the end, and bears two supra-anal spines (figs. 158, 159) on separated papillae, the spines not longer than the papillae themselves. Claws short, unarmed, tibiae with two clavate hairs. Ocelli (fig. 160) placed as usual in this genus. Antennae hardly longer than the head. The second, third, and fourth segments about equal and somewhat longer than the first. The third and fourth are broad. The mucro (fig. 161) is of a different form from any described or figured so far, the recurved hook at its end being quite characteristic of the species. The dentes and mucrones together are about one-third longer than the claw. Length, 0.9 mm. Taken rather rarely in damp places under boards along the Mississippi bottom lands, where they live socially."

Minnesota.—J. E. Guthrie (Univ. of Minn.).

This description and the accompanying figures have been copied from Guthrie, as I have not seen specimens of the species.

XENYLLA MARITIMA Tullberg.

Plate 19, figs. 162–166.

Xenylla maritima Tullberg, 1869, 1871, 1872.—Lubbock, 1873.—Brook, 1883.—MacGillivray, 1891.—Schött, 1891*b*, 1894*a*.—Uzel, 1891.—Schäffer, 1896.—Poppe and Schäffer, 1897.—Lie-Pettersen, 1898.—Scherbakov, 1898.—Carl, 1899.—Wahlgren, 1899*b*.—Börner, 1901*d*.—Krausbauer, 1901.—Ågren, 1903.—Carpenter and Evans, 1904.—Axelson, 1905, 1906.—(Axelson) Linnaniemi, 1907, 1912.—Caroli, 1914.

Grayish blue. Eyes five on each side. Antennae slightly shorter than the head. Fourth antennal segment with four olfactory hairs: three lateral and one dorsal. Unguis (fig. 162) stout, without teeth or with a single small tooth. Tenent hairs two, knobbed. Rami of tenaculum tridentate. Manubrium with a deep median-longitudinal ventral furrow. Dens and mucro confluent (fig. 163); dental region with two setae; mucronal portion with a blunt apical hook, an anteapical notch, and a narrow lamella. Anal spines two (figs. 164, 165), small, stout, curving slightly forward, on broad contiguous papillae. Clothing (fig. 166) of sparse curving setae, some of which are denticulate. Length, 1.5 mm.

Xenylla maritima, which occurs in most parts of Europe and in northern Africa, has been recorded from California by Schött ('91, p. 24). I have seen no American examples of this species, but have studied 14 European specimens which I received from Dr. Caesar Schäffer.

California.—About 30 specimens, Dr. Gustav Eisen (Zool. Mus. Upsala).

Tribe PSEUDACHORUTINI Börner.

Pseudachorutini Börner, 1906.

KEY TO GENERA OF PSEUDACHORUTINI.

1. Furcula present..2.
   Furcula absent; unguiculus absent........................5.
2. Anal spines absent..3.
   Anal spines present..4.

3. Eyes eight on each side; lamella of mucro simple . . *Pseudachorutes* Tullberg, p. 500.
Eyes five on each side; lamella of mucro with oblique pocketlike lobes.
Odontella Schäffer, p. 502.
4. Anal spines three; unguiculi and postantennal organs absent; furcula short and weak; mucro hooked; eyes usually eight (sometimes five) on each side.
Friesea Dalla Torre, p. 499.
Anal spines two; unguiculi and postantennal organs present; mucro lamellate; eyes five on each side.................................*Xenyllodes* Axelson.
5. Postantennal organs present..6.
Postantennal organs absent...7.
6. Eyes five on each side or none; mouth parts not greatly reduced, not projecting in a cone; maxilla distally toothed................*Anurida* Laboulbène, p. 503.
Eyes two or four on each side; mouth parts greatly reduced, projecting in a short cone; maxilla stilettolike, untoothed.....................*Micranurida* Börner.
7. Eyes two or three on each side or none; mouth parts greatly reduced; projecting in a cone.......................................*Paranura* Axelson, p. 506.

The genus *Brachysius* MacGillivray ('93*b*, p. 317) is evidently synonymous with *Pseudachorutes* Tullberg. I have not seen specimens of *Brachysius dilatatus* MacGillivray, the cotypes of which have been misplaced, and in the absence of data in regard to the mucrones and ungues can not place the species at present.

Genus FRIESEA Dalla Torre.

Triaena TULLBERG, 1871.
Friesea DALLA TORRE, 1895.

Eyes 16. Postantennal organs absent. Antennae four-segmented. Mandible without molar surface. Head of maxilla simple. Unguiculus absent. Furcula short, weakly developed; mucro hooklike. Anal spines three. Anal segment small; supra-anal valve rounded, semi-globose. Body without segmental tubercles. Cuticula tubertuberculate.

FRIESEA CALDARIA Guthrie.

Plate 19, figs. 167, 168.

Friesia caldaria GUTHRIE, 1903.

"Purplish blue above, paler beneath. Eye spots conspicuously black. Body short and thick, with antennae, legs, and furcula to correspond. Head triangular in outline as seen from the side. Claw rather short and stout, tibiae with two clavate hairs nearly as long as the claw. The fifth and sixth segments of the abdomen bear dorsally several clavate hairs. The furcula is more rudimentary than in any other genus, the manubrium being very short and broad, the mucrones hooked at the end, and two-thirds as long as the dentes. Dentes and mucrones together are but little longer than the larger anal horns. The three anal horns (fig. 167) are situated in a triangle, the hindmost one being median and somewhat smaller than the other two. Each one is set on a short papilla (fig. 168). There is present a well-developed tenaculum, with two-toothed blades much as in

Achorutes. The skin is thickly covered with small conical chitinous tubercules. Length, 0.75 mm.

"Under boxes and plant jars in university greenhouse, where the dirt is quite moist."

Minneapolis, Minnesota, J. E. Guthrie (Univ. of Minn.).

I have never seen this species, hence have simply copied Guthrie's description and figures. Linnaniemi ('12, p. 58) says it is rather likely that Guthrie's species is his *Friesea claviseta*, described in 1900 (Axelson, '00, p. 112).

Genus PSEUDACHORUTES Tullberg.

Pseudachorutes TULLBERG, 1871.

Eyes eight on each side. Postantennal organs usually present, with 6 to 20 peripheral tubercles. Antennae conical, four-segmented. Mouth parts reduced, suctorial, projecting in a cone. Unguiculi absent. Furcula present, not extending to the ventral tube. Anal spines absent. Cuticula tuberculate.

KEY TO SPECIES OF PSEUDACHORUTES.

Dark blue or grayish blue throughout; postantennal organs oval.
  Mucrones elongate triangular; ungues untoothed; tenent hairs absent; postantennal organs with 20 to 25 peripheral tubercules.........*complexus*, p. 501.
  Mucrones subcrescentic; ungues unidentate; one clavate tenent hair; postantennal organs with 10 or 11 peripheral tubercles.......................*lunatus*, p. 501.
Pale purple; mesothorax and last two body segments pale orange; postantennal organs round...*aureofasciatus*, p. 500.

PSEUDACHORUTES AUREOFASCIATUS Harvey.

Plate 19, figs. 169–173.

Gnathocephalus aureofasciatus HARVEY, 1898.

Pale purple above, excepting the mesothorax and the last two abdominal segments, which are pale orange. Eyes (fig. 169) eight on each side. Postantennal organ (fig. 169) with 12 to 15 peripheral tubercles arranged in a rosette. Antennae subequal to head in length (excluding the mouth parts), not approximate basally, with segments as 10:9:10:12 in relative lengths; third and fourth segments subconfluent. Buccal cone long (fig. 170). Ungues (fig. 171) stout, strongly curving, with one or two teeth behind the middle of the inner margin. Tenent hairs absent. Furcula short and stout. Mucrones half as long as dentes, spoon-shaped (fig. 172). Cuticular tubercles larger and more pointed on the last two abdominal segments than elsewhere. Long stout blunt curving hairs (fig. 173) occur sparsely on the head, numerously on the last three abdominal segments, and in a single transverse row on each of the first six body segments. Length, 1.5 mm.

My additions to Harvey's description have been made from a study of two of the cotypes.

Described originally from five cotypes, found on a decorticated log in low damp woods, Orono, Maine, September, 1897, by F. L. Harvey.

PSEUDACHORUTES COMPLEXUS MacGillivray.

Plate 20, figs. 174–180.

Gnathocephalus complexus MACGILLIVRAY, 1893*b*.

Dark blue, with a lateral row of pale spots. Head strongly produced between the antennae. Eye patches black, small, convex. Eyes eight on each side of the head (fig. 174). Postantennal organs (fig. 175) with about 20 to 25 peripheral tubercles arranged in an oval. Antennae (fig. 176) shorter than the head, basally approximate, with segments as 12:9:8:12 in relative lengths; basal segment one-half broader than long; second three-quarters as broad as the first, cup-shaped; third and fourth each one-half as broad as the first and separated by an indistinct oblique suture; fourth segment rounded-conical. Mouth parts (fig. 177) suctorial, elongate, projecting in a cone one-half as long as the head. Body stout, gradually dilating. Tibiotarsus with two large white spots; femur with one. Ungues (fig. 178) long, slender, uniformly tapering, strongly curving, untoothed, basally pigmented, shortest on the first pair of feet. Unguiculi absent. Tenent hairs absent. Furcula short, extending to the posterior border of the genital segment. Manubrium stout. Dentes (fig. 179) subcylindrical, with 11 or more large conical dorsal tubercles. Mucro (fig. 179) two-thirds as long as dens, elongate-triangular in lateral aspect, terminating in a small rounded upturned lobe. Anal spines absent. Antennae, legs, and furcula with many long stiff setae; anal and genital segments with numerous stiff setae of moderate length; remaining body segments almost naked, each with a single transverse row of short curving setae (fig. 180). Cuticula finely tuberculate. Length, 3–4 mm.

The present description and figures of this species have been made from a single cotype sent to me by MacGillivray.

Olympia, Washington, T. Kincaid.

PSEUDACHORUTES LUNATUS, new species.

Plate 20, figs. 181–186.

General color grayish blue; pigment blue, mottled, interspersed with close rounded pale spots; sternum, legs, and furcula unpigmented; antennae blue. Eyes (fig. 181) eight on each side; eye spots black. Postantennal organs (fig. 182) with 10 to 12 peripheral tubercles arranged in an oval. Antennae shorter than the head; third and fourth segments confluent. Mouth parts projecting in a cone. Unguis (fig. 183) stout, slightly curving, with inner margin unidentate one-third from the base. Tenent hair single, long, clavate. Tenaculum tridentate. Dentes stout, swollen dorsally, with coarse dorsal tubercles (fig. 184). Mucrones (fig. 185) two-fifths as long as dentes, subcrescentic, with large outer and inner lamellae and deep acute incision between the outer lamella and the apex. Clothing of sparse short curving setae (fig. 186), with longer and stiffer setae on the posterior part of the abdomen. Length, 3 mm.

Urbana, Illinois, May 9, in a damp log.

Cotypes.—Cat. No. 19905 U.S.N.M.

Genus ODONTELLA Schäffer.

Odontella Schäffer, 1897.—Ågren, 1904.—Börner, 1909—(Axelson) Linnaniemi, 1912.

Xenyllodes Axelson, 1903*a* (part).

Body stout. Mouth parts suctorial, projecting in the form of a cone. Eyes five on each side. Postantennal organ with four (five in *O. thauma* Börner) peripheral confluent lobes. Antennae shorter than the head, four-segmented. Unguiculus absent. Furcula not reaching the ventral tube. Mucro with two pocketlike dorso-lateral lobes. Anal spines absent, or represented by two or more modified abdominal tubercles. Integumentary tubercles coarse, tooth or thornlike.

ODONTELLA EWINGI, new species.

Plate 21, figs. 187–197.

Eye patches black, oval. Eyes (fig. 187) five on each side. Postantennal organ (fig. 188) with four peripheral confluent lobes, of which the posterior is shorter than the others. A median pseudocellus occurs near the postero-dorsal margin of the head. On each side of the head are six to eight stout conical spines (figs. 189, 190). Antennae shorter than the head, stout; segments as 2:3:2:2 in relative lengths; the two basal segments four times as broad as long and contiguous. Buccal cone (fig. 190) half as long as the head. Several stout conical spines, similar to those of the head, occur on each of the legs; there being one on each trochanter and one on each femur (fig. 191). Long outstanding hairs occur on the legs, as in figure 191. Tibiotarsus divided into two segments by an obsolete suture (fig. 191). Unguis (fig. 192) stout, with a long slender tooth at the base of the inner margin, and a pair of prominent basal lateral teeth (fig. 193). Dentes stout, bearing dorsally two setae and three stout spines (fig. 194). Mucrones (fig. 194) almost as long as dentes, slightly longer than hind ungues; outer lamella modified to form two large oblique pocketlike lobes; inner lamella narrow; apex spoonlike. Setae of the body (fig. 195) sparse, recurving, mostly short, becoming longer on the posterior part of the abdomen. Integumentary tubercles (fig. 196) coarse, tooth or thornlike, largest toward the apex of the abdomen, longitudinally furrowed, the outlines of their bases forming the characteristic patterns shown in figure 197. Anal spines represented by two slightly modified integumentary tubercles, as in figure 196. Length, 2 mm.

Described from 11 cotypes, Corvallis, Oregon, December 25, under wood on moist ground. Collected by Dr. Henry E. Ewing, after whom the species is named.

Cotypes.—Cat. No. 19906, U.S.N.M.

Genus ANURIDA Laboulbène.

Achorutes, Guérin, 1836.
Anoura Nicolet, 1847.
Anurida Laboulbène, 1865.
Aphoromma MacGillivray, [1893*b*.]
Anuridella, Willem, 1906.

Eyes 10 or none. Postantennal organ present; peripheral tubercles several or many, arranged in a circle in most species. Mouth parts not projecting in a cone. Head of maxilla with three toothed lamellae. Mandibles without molar surface. Unguiculus absent. Furcula absent. Anal spines absent. Pseudocelli absent. Body without large segmental tubercles. Cuticular tubercles present.

KEY TO SPECIES OF ANURIDA.

Dark blue or bluish gray. Eyes 10.
  Postantennal organs with 6 to 10 peripheral tubercles, arranged in a circle, *maritima*, p. 503.
  Postantennal organs with 17 to 40 peripheral tubercles, arranged in a regular or irregular ellipse.
    Peripheral tubercles 17 to 30; ungues slender, feebly unidentate or untoothed .... *tullbergi*, p. 504.
    Peripheral tubercles 30 to 40; ungues stout, strongly unidentate...... *amorita*, p. 505.
White; eyes absent .... *granaria*, p. 506.

ANURIDA MARITIMA Guérin.

Plate 22, figs. 198–202.

Achorutes maritimus Guérin, 1836.
Anoura maritima Nicolet, 1847.
Anurida maritima Laboulbène, 1865.—Packard, 1873.—MacGillivray, 1891, 1893*b*, 1894.—Schött, 1894*a*, 1894*b*.—Dalla Torre, 1895.—Schäffer, 1896.—Carpenter and Evans, 1899.—Willem, 1900.—Evans, 1901*a*, 1908.—Davenport, 1903.—Imms, 1906.
Lipura maritima Lubbock, 1873.

Blackish blue. Eyes (fig. 198) five on each side. Postantennal organs (fig. 199) with 6 to 10 peripheral tubercles arranged in a rosette. Antennae shorter than the head; last two segments confluent dorsally, distinct ventrally; sense-organ of third segment as in figure 200; subapical sense-organ of fourth segment large, trilobed. Unguis (fig. 201) slender, unidentate a little behind the middle of the inner margin or untoothed. One tenent hair, unknobbed. Clothing of abundant closely set setae (fig. 202) the larger setae denticulate. Length, 3 mm.

In 1898 I sent Massachusetts examples of this species to Dr. Caesar Schäffer, who reported that they agreed with European specimens of *Anurida maritima*.

Anurida maritima is strictly a maritime species. It occurs abundantly on the seashore chiefly between tide marks, and at low tide may be seen crawling about on rocks, sand, seaweed, driftwood, etc., and feeding on dead mollusks or crustaceans. As the tide rises the insects burrow into the sand or crawl into crevices in rocks or other objects, and become submerged; the hairy clothing retaining a supply of air sufficient to enable these insects to survive under water until the tide falls; or even for several days if necessary.

This collembolan, a most serviceable species for investigation, has been the subject of an important monograph by Imms ('06).

In Europe, *Anurida maritima* has been reported from Sweden, Denmark, Germany, Holland, Belgium, France, and Great Britain. In this country it is a common species along the Atlantic coast.

Massachusetts.—Salem, A. S. Packard, jr. (M. C. Z.). Boston, July 28, August 3, 4, 8, 10, 11, 20, 25, September 1, October 20. Neponset, May 4, October 10, 20, November 20. Duxbury, September 27, J. J. Skidmore. Buzzards Bay, J. E. Todd (M. C. Z.). Woods Hole, A. M. Claypole. Nantucket, A. S. Packard, jr. (M. C. Z.).

New York.—Cold Spring Harbor, Long Island, C. B. Davenport.

New Jersey.—A. E. Verrill.

Florida.—E. Lönnberg.

ANURIDA TULLBERGI Schött.

Plate 22, figs. 203–205.

Anurida tullbergi Schött, 1891*a*, 1894*a*, 1894*b*, 1902.—MacGillivray, 1894.—Reuter, 1895.—Schäffer, 1896.—Lie-Pettersen, 1898.—Scherbakov, 1898.—Börner, 1901*d*.—Carl, 1901.—Ågren, 1903.—Guthrie, 1903.—Axelson, 1905*a*.—(Axelson) Linnaniemi, 1907, 1912.

Bluish black above, gray beneath; pigment in flecks or in a network on a yellowish-white ground. Eyes five on each side. Postantennal organ (fig. 203) with 17 to 30 (commonly 20 or 21) peripheral tubercles arranged in a more or less irregular ellipse. Fourth antennal segment with a dorsal subapical trilobed sense-organ, and with five olfactory hairs (fig. 204) as follows: Two outer, one upper, and one inner, and between the two outer a fifth hair one-third as long as the others. Third antennal segment with one distal dorsal olfactory hair. Sense-organ of third antennal segment with two free rods, unprotected by either an integumentary fold or by guard-setae. Unguis (fig. 205) slender, usually unidentate, rarely untoothed, with a small toothlike projection at its base. No knobbed tenent hairs. Clothing of sparse short setae, interspersed with longer setae, the latter numerous on the posterior part of the abdomen. Cuticular tubercles very small. Maximum length, 3 mm.

The preceding description is compiled from European authors for the most part; the only specimens that I have seen being two from the Guthrie collection, which were kindly sent to me by Prof. H. F. Nachtrieb. In these I could not, however, study the eyes, postantennal organs, and antennal sense-organs, as the specimens were mounted permanently in balsam without depigmentation.

In Europe this species occurs on the seashore under seaweed or wood, or on pools of water; and also inland under wood or stones and on pools of fresh water.

Anurida tullbergi has been found in Norway, Sweden, Finland, Russia, Germany, and Switzerland.

In North America the species has been reported from Florida by Schött ('94*b*) and by MacGillivray ('94), and from Minnesota by Guthrie ('03).

ANURIDA AMORITA Folsom.

Plate 7, fig. 3; plate 22, figs. 206–211.

Anurida amorita FOLSOM, 1902*b*.—AXELSON, 1903*b*.

General color bluish gray, due to the combined effect of indigo blue mottlings and the white ground color (fig. 3). The dorsum of each segment has two parallel broken blackish stripes (fig. 3). Eyes (fig. 206) five on each side, on blackish patches. Postantennal organs (figs. 207, 208) with 30 to 40 peripheral tubercles arranged elliptically or subelliptically. Antennae almost as long as the head; segments as 12:12:11:10, in relative lengths; first three segments dilated apically; fourth rounded conical, with a large subapical sense-organ (fig. 209) consisting of three contiguous bladderlike structures on a chitinous base. Body (fig. 3) elongate, abdomen gradually dilated. Ungues of mid and hind feet (fig. 210) gradually tapering from a broad base, slightly curving, strongly unidentate near the middle of the inner margin; ungues of fore feet (fig. 211) smaller and less tapering. No knobbed tenent hairs. Clothing of dense short curving setae, with a transverse row of long hairs on each segment. Maximum length, 4.1 mm.

Anurida amorita was collected at Kukak Bay, Alaska, by the Harriman Expedition, and has been reported from Siberia by Axelson.

Cotypes.—Cat. No. 5437, U.S.N.M.

ANURIDA GRANARIA Nicolet.

Plate 22, figs. 212–214.

Anoura granaria NICOLET, 1847.—LUBBOCK, 1862, 1873.—MACGILLIVRAY, 1891.

Anurida granaria TULLBERG, 1869, 1871, 1872.—DALLA TORRE, 1888.—UZEL, 1890.—SCHÖTT, 1894.—REUTER, 1895.—SCHÄFFER, 1896, 1900.—CARPENTER, 1897, 1900.—LIE-PETTERSEN, 1897, 1898.—CARPENTER and EVANS, 1899.—SCHERBAKOV, 1899.—WAHLGREN, 1900.—EVANS, 1901*a*.—AXELSON, 1905*a*.—(AXELSON) LINNANIEMI, 1907, 1912.—COLLINGE and SHOEBOTHAM, 1910.—SHOEBOTHAM, 1914.

Aphoromma granaria MACGILLIVRAY, 1893*b*.—WILLEM, 1902.—GUTHRIE, 1903.—WAHLGREN, 1906*a*.

White. Buccal cone short. Eyes absent. Postantennal organs (figs. 212, 213) with 12 to 21 elliptical to ovate peripheral tubercles arranged in a rosette. Antennae shorter than the head, stout, conical, with segments subequal in length; fourth segment with eight short, stout, olfactory hairs. Abdomen scarcely dilated. Unguis (fig. 214) untoothed. No knobbed tenent hairs. Clothing of sparse minute curving setae and occasional longer setae, the latter most numerous on the head and the posterior part of the abdomen. Cuticular tubercles large. Maximum length, 1.8 mm.

My specimens of this species, collected in Neponset, Massachusetts, November 20, agree with a single European example that I received from Doctor Schäffer.

This species occurs in such diverse situations as these: on the seashore under stones and wood; inland under stones, under loose bark, and in humus; in caves.

Anurida granaria is widely distributed in Europe and is well known from the Arctic region, having been recorded from Siberia, Franz Josef Land, Spitzbergen, Jan Mayen Land, and Greenland.

Genus PARANURA Axelson.

Börneria AXELSON, 1902.

Paranura AXELSON, 1902, 1912.

Body stout; abdomen but little dilated; sixth abdominal segment small; supra-anal lobe semicircular. Segmental tubercles absent. Eyes three or two on each side, or absent (in the known species). Postantennal organs absent. Antennae conical, four-segmented; fourth segment with terminal sense-tubercles and with olfactory hairs; third segment with a pair of sense-papillae and two guard setae. Mouth-parts piercing-suctorial, projecting forward in a short sharp conical tube; mandibles without a molar surface, and with three or more incisive teeth; maxillae and paraglossae apically styliform. Unguiculus absent. Ventral tube short and stout. Tenaculum absent. Furcula, anal spines, and anal papillae absent. Cuticula tuberculate.

I have enlarged the description of the genus in order that it may include the eyeless species described here. This genus has hitherto been found only in Finland and Norway.

PARANURA CAECA new species.

Plate 22, figs. 215, 216; plate 23, figs. 217–221.

White or pale yellow. Eyes absent. Antennae shorter than the head; segments in relative lengths as 14:13:11:9; segments three and four confluent dorsally, damarcated ventrally. Olfactory hairs of third and fourth antennal segments 9 or 10 (fig. 215), including a large dorsal semicircular hair. Sense-organ of third antennal segment as in figure 216. Buccal cone acute, about as long as the width of its base. Mandibles and maxillae as in figures 217 and 218. Unguis untoothed (fig. 219). Unguiculus represented by a minute tooth, near which a slender seta (fig. 220) often occurs. Tenent hairs absent. Cuticular tubercles small. Clothing of sparse stiff setae (fig. 221), which are simple (nonserrate). Maximum length, 2.5 mm.

The larger individuals are yellow, the smaller ones white. There are no traces of eyes or of ocular pigment.

Paranura caeca is a sluggish species of the humus-fauna. I have found it in woodlands among damp, dead leaves and in damp soil.

Urbana, Ill., April 12, 13, 19, 20, 25, 26, May 2, November 8, December 21.

Cotypes.—Cat. No. 19907, U.S.N.M.

Tribe NEANURINI Börner.

Neanurini Börner, 1901*d*.
Achorutini Börner, 1906.

KEY TO GENERA OF NEANURINI.

Head of maxilla needlelike, without lamellae and teeth . . *Neanura* MacGillivray, p. 507.
Head of maxilla with toothed lamellae . . . . *Protanura* Börner.

Genus NEANURA MacGillivray.

Achorutes Templeton, 1835 (part).—Nicolet, 1841.
Anoura Gervais, 1842.—Lubbock, 1862.
Anura Nicolet, 1847.—Tullberg, 1869, 1871, 1872.
Neanura MacGillivray, 1893*b*.
Achorutes Börner, 1906.

Eyes usually present. Postantennal organs present or absent. Antennæ conical. Buccal cone present. Mouth parts suctorial. Head of maxilla without toothed lamellae. Unguiculi absent. Furcula and anal spines absent. Body with segmental reticulated tubercles, which are usually large; abdomen often terminating in two or four large rounded tubercles. Anal segment relatively large; supra-anal valve bilobed. Anal spines absent. Integument tuberculate. Pseudocelli absent.

KEY TO SPECIES OF NEANURA.

Blue species. (See also *Neanura magna*, p. 510.

  Segmental tubercles not black; eyes three on each side; postantennal organs absent .... *muscorum*, *p*. 508.

  Segmental tubercles black; eyes five on each side.

    Postantennal organs absent; unguis untoothed .... *serrata*, *p*. 511.

    Postantennal organs present, each with more than 100 peripheral tubercles; unguis unidentate .... *gigantea*, *p*. 509.

White species.

  Eyes two on each side; unguis untoothed .... *quadrioculata*, *p*. 512.

  Eyes three on each side; unguis unidentate .... *ornata*, *p*. 511.

NEANURA MUSCORUM Templeton.

Plate 7, fig. 4; plate 23, figs. 222–225.

Achorutes muscorum TEMPLETON, 1835.—BÖRNER, 1906.—(AXELSON) LINNANIEMI, 1912.—CAROLI, 1912.

Anoura muscorum NICOLET, 1847.—LUBBOCK, 1862, 1873.—PARONA, 1879, 1888.

Anura muscorum TULLBERG, 1869, 1871, 1872, 1876.—DALLA TORRE, 1888.—UZEL, 1890.—SCHÖTT, 1894.—REUTER, 1895.—MEINERT, 1896.—SCHÄFFER, 1896.—LIE-PETTERSEN, 1897, 1898.—CARPENTER and EVANS, 1899.—WILLEM, 1900.—EVANS, 1901*a*, 1901*b*.

Anura gibbosa PACKARD, 1873.

Anoura gibbosa MACGILLIVRAY, 1891.

Neanura muscorum MACGILLIVRAY, 1893*b*.—DALLA TORRE, 1895.—SCHÄFFER, 1896, 1900*a*, 1900*b*.—POPPE and SCHÄFFER, 1897.—SCHERBAKOV, 1898*a*, 1898*b*.—CARL, 1899, 1901.—ABSOLON, 1900*a*, 1900*b*, 1901*a*, 1901*b*.—BÖRNER, 1901*d*, 1902, 1906.—KRAUSBAUER, 1901.—WILLEM, 1902.—ÅGREN, 1903, 1904.—GUTHRIE, 1903.—AXELSON, 1904, 1905*a*, 1905*b*, 1906.—(AXELSON) LINNANIEMI, 1907, 1909.—WAHLGREN, 1906*a*.—COLLINGE and SHOEBOTHAM, 1910.—SHOEBOTHAM, 1914.

Anoura sextuberculata HARVEY, 1896.

Grayish blue or dark blue; mottled. Eyes (fig. 222) three on each side of the head, not on black patches. Postantennal organs absent. Antennae shorter than the head; third and fourth segments coalescent. Unguis (fig. 223) untoothed. Unguiculus absent. Tenent hairs absent. Furcula absent. Abdomen ending in four large rounded tubercles (fig. 4). Head with 12 tubercles (figs. 4, 224) as follows: A small tubercle between the bases of the antennae; a transverse row of five, including the ocular tubercles and a large median tubercle; a transverse posterior series of six, in which the two dorsal tubercles are small. Basal antennal segment with a dorsal tubercle; second segment with a trace of tuberculation. Prothorax with six tubercles, the dorsal pair being minute. Mesothorax to fourth abdominal segment, inclusive, with eight tubercles each. Genital segment with four large tubercles; anal segment with two. Anal segment visible from above. Clothing of long white hairs. Length, 2 mm.

Specimens from Massachusetts agree with European examples, as I learned by an exchange of specimens with Dr. C. Schäffer.

Packard's two cotypes of *Anura gibbosa*, in the Museum of Comparative Zoölogy, agree perfectly with my three European representatives of *Neanura muscorum*.

Harvey gave me cotypes of his *Anoura sextuberculata*, which proved to be *N. muscorum*.

This common species occurs in damp decaying logs and under logs or dead leaves on damp soil.

Maine.—Brunswick, September, A. S. Packard, jr. (M. C. Z.). Orono, May, October 11, F. L. Harvey.

New Hampshire.—Walpole, July 15.

Massachusetts.—Cambridge or Arlington, March 27, April 8, 11, 15, 17, 19, 23, May 1, 2, 23, June 1, 12, July 6, 10, 16, August 19, 26, September 10, 30, October 14, November 6. Dedham, July 21.

New York.—A. D. MacGillivray.

Pennsylvania.—Harrisburg, November 6, H. A. Surface.

Ohio.—Yellow Springs, August 28.

Illinois.—Urbana, November 2. Dubois, April 28, C. A. Hart.

Minnesota.—J. E. Guthrie (Univ. Minn.).

Canada.—Toronto, Ontario, June 26, R. J. Crew.

In most parts of Europe, *Neanura muscorum* is one of the commonest species of Collembola.

NEANURA GIGANTEA Tullberg.

Plate 7, fig. 5; plate 23, figs. 226–228.

Anura gigantea TULLBERG, 1876.—SCHÖTT, 1894.

Neanura gigantea SCHÄFFER, 1900*b*.—FOLSOM, 1902*b*.—AXELSON, 1903*b*.—WAHLGREN, 1907.

General color of alcoholic specimens dark blue, with conspicuous blackish tubercles (fig. 5); living examples pruinose (Tullberg). Head twice as broad as long, with 12 large tubercles, including those bearing the eyes, arranged as in figure 5. Eyes (fig. 226) five on each side. Postantennal organs (fig. 227) each composed of more than 100 clavate papillae, forming a rosette. Antennae half as long as the head, conical, with segments related in length as 4: 3: 2: 6; basal and second segments half as long as broad; third and fourth coalescent; the minute antennal tubercles become successively smaller on each segment. Body oval in dorsal aspect. The number of large tubercles on each successive segment is, respectively, 6, 8, 8, 8, 8, 8, 8, 6, 2; the tubercle at each end of each transverse row is behind the others on the first seven segments; on the seventh both are also ventral and inconspicuous; on the eighth four tubercles are ventral and two dorsal; the ninth segment is invisible from above and bears two small tubercles. Legs short and stout. Ungues (fig. 228) alike, stout, uniformly curving and tapering, strongly unidentate on the inner margin and minutely tuberculate. Cuticula finely tuberculate. Large tubercles reticulate (fig. 226), bearing several long stiff yellow setae. Maximum length, 5 mm.

In the males, breadth is to length as 1: 2.27; in the females, as 1: 1.79.

This well-marked and monstrous species has been recorded from several localities in Siberia by Tullberg, Shött, and Axelson; from Ellesmere Land by Wahlgren; and was found by the Harriman Expedition at St. Paul Island, Bering Sea.

NEANURA MAGNA MacGillivray.

Plate 23, figs. 229, 230.

Anoura magna MacGillivray, 1893*a*.

"Body short, broad, one-half as broad as long, finely granulated. Each segment with four dorsal and two lateral globular tubercles, except the last, which is deeply divided, having as its apex two immense globular tubercles. On the anterior part of the anterior margin of each segment another smaller tubercle. From each tubercle there arise from four to eight short, stiff, yellow bristles. On the dorsal part of the head the number of tubercles is the same, but the two median tubercles are placed on the caudal portion of a large quadrangular tubercle, which reaches from between the bases of the antennae to the caudal part of the head. The ground color is a light steel blue, with lighter spots between the darker tubercles. Antennae very short, not reaching the lateral margin of the body by at least a quarter of its width, segments subequal, indistinctly marked. Eyes at the side of the base of the quadrangular tubercle, postantennal organs wanting. Buccal orifice blunt, short, and white. Legs short, with a single strong claw. Length, 5 mm. (0.20 inch). Habitat: Salineville, Ohio.

"This species can be recognized by its size, color, and the globular tubercles; from *gigantea* Tullberg, its nearest ally, from Siberia, by the absence of the postantennal organ." (MacGillivray.)

The following notes, which I made from a cotype given to me by Doctor MacGillivray, will assist in the identification of this species. Prothorax with eight segmental tubercles, equal in size. Mesothorax and metathorax each with eight, of which two lateral tubercles are posterior to the rest. First three abdominal segments each with eight. Fourth abdominal segment with eight visible from above (fig. 229); an anterior row of six, and a postero-lateral tubercle on each side. Genital segment in dorsal aspect with two large terminal tubercles (fig. 229). Anal segment not visible from above. Unguis (fig. 230) stout, curving, strongly unidentate one-third from the base of the inner margin.

The single specimen at my disposal was lost before I had ascertained the number of its eyes.

NEANURA SERRATA, new species.

Plate 24, figs. 231–235.

General color dark blue; ground color grayish blue, mottled; segmental tubercles blackish. Eyes (fig. 231) five on each side. Postantennal organs absent. Antennae subequal to head in length, separated basally; last two segments confluent. Olfactory hairs of fourth antennal segment (fig. 232) five or six: three or four inner, one outer, and one dorsal. Sense-organ of third antennal segment as in figure 233. Unguis (fig. 234) stout, curving, untoothed. Tibiotarsal hairs as in figure 234. Anal segment not visible from above. Basal antennal segment with one dorsal tubercle. Head with 12 tubercles, as follows: one between the bases of the antennae; five in a transverse row, including the two ocular tubercles; four in a posterior transverse series, in which the tubercle at each end represents two united tubercles; two small tubercles, each antero-lateral in position. First six body segments each with eight tubercles, six of which are visible dorsally. Seventh segment with six tubercles, four of them visible from above. Genital segment with four, two evident dorsally. Anal segment with four, visible only ventrally, two being supra-anal and two infra-anal. Clothing of conspicuous stout yellow setae, serrate or feathered (fig. 235), mostly very long; the length of the longest being more than one-third the greatest width of the body; in addition to these there are numerous minute simple setae. Length, 2.4 mm.

Found under boards and rotten logs in moist soil. One specimen had teleutospores of Uredineae in the alimentary canal.

Oregon.—Corvallis, February 5, March 22, H. E. Ewing; March 11, A. L. Lovett.

Cotypes.—Cat. No. 19908, U.S.N.M.

NEANURA ORNATA Folsom.

Plate 7, fig. 6; plate 24, figs. 236–240.

Neanura ornata FOLSOM, 1902*b*.—AXELSON, 1903*b*.—CAROLI, 1912.

White (fig. 6). Head (fig. 236) slightly longer than broad, rounded triangular. Eyes (fig. 236, *e*, *e*, *e*) not more than three on each side, in longitudinal alignment; two are close together and immediately behind the base of the antenna; the third is considerably behind these. The eyes are rudimentary; they lack pigment, and even the cornea, especially of the posterior eye, is frequently indistinguishable. Postantennal organs absent. Antennae (fig. 237) barely more than half as long as the head, with segments related as 5:4:4:6; basal segment stout, globose, reticulate; second and third globose, slightly or not at all reticulate; fourth conical, reticulate; the minute tubercles successively smaller on the first three segments but of equal size on the second and fourth. The large tubercles which characterize the genus coalesce on the head of this species, but are indicated by the arrangement of the setigerous, reticulated areas. Buccal cone is in figure 238. Body segments related in length as 3:4:5:6:5:5:4:2:2; anal segment reduced and not visible from above. The number of large tubercles on each successive segment is, respectively, 6, 8, 8, 8, 8, 8, 8, 6, 2. On the fourth abdominal segment the two dorsal tubercles coalesce and four tubercles are ventral. On the genital segment all six coalesce. On the anal segment the two tubercles are ventral. Each tubercle, though but slightly elevated, is defined by its chitinous reticulation and by two to four stiff serrulate setae of two forms (fig. 239). The minute cuticular tubercles are conical (fig. 239) and frequently clustered. Legs short and stout, with stout curving setae. Ungues (fig. 240) alike, apically curving, prominently unidentate at the base of the inner margin. Length, 1.4 mm.

In the males (fig. 6) the abdomen gradually dilates, and the breadth is to the length as 1:2.8; the females are oval-cylindrical, with breadth to length as 1:2.

In my original description of this species I stated, "tibiae with a subapical pair of appendages, pyriform in outline." These are shown in figure 240. They are not present on all of my specimens, but occur on many of them, singly or in pairs, near the end of the tibiotarsus. Axelson ('03*b*, p. 3) failed to find them in his seven Siberian specimens; and Caroli ('12, p. 365) regards them as perithecia of Laboulbeniaceae; hence I admit that they may be parasitic fungi.

The 35 cotypes of *Neanura ornata* were collected at Sitka, Alaska, by the Harriman Expedition; and the species has since been recorded from Siberia by Axelson.

Cotypes.—Cat. No. 5435, U.S.N.M.

NEANURA QUADRIOCULATA Guthrie.

Plate 25, figs. 241–245.

Neanura quadrioculata GUTHRIE, 1903.—BARBER, 1913.

"Entirely white except the two black eye patches on each side of the head, each eye patch containing a single ocellus." The eyes are shown in figures 241 and 242. Postantennal organs absent. Antennae shorter than the head; last two segments confluent. Olfactory hairs of fourth antennal segment eight in number: six inner and two outer, including a stout semicircular giant-hair, as in figure 243. Third antennal segment with an anterior dorso-lateral olfactory hair (fig. 243). Mouth parts piercing-suctorial, projecting in a conspicuous cone (fig. 244). Mandibles and maxillae styliform; the former without molar surface, the latter without terminal toothed lamellae. Unguis (fig. 245) stout, curving, without teeth. Unguiculus absent. Tenent hairs absent. Sixth abdominal segment visible from above. Supra-anal valves bilobed; infraanal valves bilobed.

Head with 10 large tubercles: one between the bases of the antennae; a transverse row of five, including the two ocular tubercles and a large median tubercle; a posterior transverse series of four, in which the two dorsal tubercles are undeveloped and are represented by a pair of small setae.

The two dorsal tubercles are similarly undeveloped and represented by two small setae on all the body segments from the prothorax to the fourth abdominal segment, inclusive. Prothorax with four segmental tubercles; mesothorax to fourth abdominal segment, inclusive, with six each; genital segment with four large tubercles; anal segment with two. The abdomen in dorsal aspect terminates in four large rounded tubercles.

The setae of the tubercles are long, stiff, and nonserrate; the remaining setae of the body are sparse, small, and curving.

Length, 1.8 mm.

I have referred my specimens to *Neanura quadrioculata* Guthrie because they agree with his description, as far as it goes; it does not go very far, however, so I am not positive that the specimens belong to that species.

The name *Neanura quadrioculata* is, by the way, preoccupied by Börner ('01), and the form that I have described here is evidently different from his. (See Börner, '01*b*, p. 432, and Linnaniemi, '12, p. 77). It remains to be seen whether Guthrie had Börner's species in hand or, as is more probable, a new species.

The nine specimens of this species that I have studied were sent to me by Mr. H. S. Barber; some of them were alive and showed the luminosity that he has described ('13, p. 46).

Jackson's Island, Maryland, June 30, in rotting hemlock log, H. S. Barber.

Virginia shore, opposite Plummer's Island, Maryland, October 18, 19, H. S. Barber.

Subfamily PODURINAE Börner.

Podurinae Börner, 1906.

Genus PODURA Linnaeus.

Podura Linnaeus, 1758.
Hypogastrura Bourlet, 1839.
Hydropodura Börner, 1901c.
Podura Börner, 1906.

Head hypognathous. Eyes near the posterior part of the head; eight on each side. Postantennal organ apparently absent, represented externally by a minute rudiment. Antennae short. Mouth parts biting; mandibles with a well developed molar surface. Body short and stout. Ungues very long and slender. Unguiculi absent. Furcula very long, extending beyond the ventral tube, clearly attached to the fourth abdominal segment. Dentes very long, strongly bowed, apically ringed, two-segmented. Mucrones lamellate. Anal spines absent. Integument tuberculate.

PODURA AQUATICA Linnaeus.

Plate 25, figs. 246–250.

Podura aquatica LINNAEUS, 1758.—NICOLET, 1841.—TULLBERG, 1871, 1872.—LUBBOCK, 1868, 1873.—PACKARD, 1873.—PARONA, 1879, 1882.—DALLA TORRE, 1888, 1895.—UZEL, 1890.—MACGILLIVRAY, 1891.—SCHÖTT, 1894, 1902.—REUTER, 1895.—SCHÄFFER, 1896, 1900*a*, 1900*b*.—LIE-PETTERSEN, 1897.—POPPE and SCHÄFFER, 1897.—SCHERBAKOV, 1898.—CARL, 1899, 1901.—WAHLGREN, 1899*b*, 1906*a*.—CARPENTER and EVANS, 1899.—ABSOLON, 1900*a*, 1901*b*.—WILLEM, 1900.—BÖRNER, 1901*d*.—KRAUSBAUER, 1901.—ÅGREN, 1903.—GUTHRIE, 1903.—AXELSON, 1906.—(AXELSON) LINNANIEMI, 1907, 1912.

Hypogastrura aquatica BOURLET, 1839.

Hydropodura aquatica BÖRNER, 1901*c*, 1902.

Podura granulata MACGILLIVRAY, 1893*b*.

Blackish blue; antennae and legs reddish brown; furcula pale brown. Eyes eight on each side (fig. 246). Ocular areas with conical elevations between the eyes. Antennae stout, cylindrical, shorter than the head, with segments about as 4:5:6:7 in relative lengths. Olfactory hairs of fourth antennal segment absent. Sense-organ of third antennal segment consisting of a pair of short stiff setae (fig. 247). A dorsal subsegment occurs on the anterior part of each body segment except the ninth. Unguis (fig. 248) slender, curving, longer than the tibiotarsus, unidentate behind the middle of the inner margin. Unguiculus represented only by a toothlike rudiment. Tenent hair single, unknobbed. Rami of tenaculum quadridentate (fig. 249). Furcula extending as far as the first pair of legs. Manubrium short. Dentes strongly bowed outward, apically convergent, with an obsolete transverse suture two-fifths from the base, and with the tubercles of the distal third arranged in transverse rings. Mucrones (fig. 250) three-fifths as long as hind ungues, with outer and inner lamellae, and with a prominent dorsolateral rounded-triangular basal lobe. Anal spines absent. Body clothing of few minute curving setae; dens with 12 to 17 long curving dorsal setae, most of which are in two longitudinal series. Length, 1.3 mm.

American specimens agree with 28 European examples which I received from Dr. Caesar Schäffer, except in having stouter bodies and appendages than the latter.

Podura granulata MacGillivray ('93*b*, p. 316) is a synonym of *P. aquatica* Linnaeus, as I have found by an examination of two of the cotypes.

Podura aquatica, one of our most abundant collembolans, occurs on the surface of standing water on the margins of ponds and streams, having special structural adaptations for a semi-aquatic life. It swarms on vegetation or rubbish along the shore, and at times is blown against the shore in masses of enormous numbers. This species often appears in fresh-water aquaria, and is essentially a fresh-water species, though it has been found occasionally in pools of brackish water on the seashore.

P. aquatica is common throughout Europe and has been taken in Siberia.

Massachusetts.—Cambridge, March 13, April 17, 22, 29, May 14. Belmont, March 27, April 19, 23. Arlington, March 13, 27, April 17, May 10. Lexington, May 10. Waltham, May 9. Weston, July 16. Dedham, July 12. Norwood, August 26.

Ohio.—Yellow Springs, February 9, April 3, August 18.

Indiana.—Bluffton, C. C. Deam.

Illinois.—Urbana, May 5, July 18, October 9. Galesburg, March, J. G. Needham.

Tennessee.—H. E. Summers.

Wisconsin.—Two Rivers, September 1.

Minnesota.—J. E. Guthrie (Univ. Minn.).

Washington.—L. M. Bremner (Stanford Univ.).

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EXPLANATION OF PLATES.

PLATE 7.

FIG. 1. *Achorutes socialis*, × 18.
2. *Achorutes armatus*, × 22.
3. *Anurida amorita*, × 14.
4. *Neanura muscorum*, depigmented to show tubercles, × 25.
5. *Neanura gigantea*, × 12.
6. *Neanura ornata*, × 45.

PLATE 8.

FIG. 7. *Achorutes tigrina*, eyes of right side, × 285.
8. *Achorutes tigrina*, left fore foot, × 450.
9. *Achorutes tigrina*, dens and mucro of right side, × 450.
10. *Achorutes copiosus*, left mid foot, × 350.
11. *Achorutes copiosus*, left mucro, × 840.
12. *Achorutes copiosus*, right mucro, × 840.
13. *Achorutes copiosus*, anal spine, × 260.
14. *Achorutes copiosus*, dorsal setae of metathorax, × 220.
15. *Achorutes maturus*, right postantennal organ, × 840.
16. *Achorutes maturus*, sense organ of third antennal segment of right side, × 840.
17. *Achorutes maturus*, left hind foot, × 840.
18. *Achorutes maturus*, left mucro, × 840.
19. *Achorutes maturus*, right mucro, × 840.
20. *Achorutes maturus*, anal spine, × 840.
21. *Achorutes maturus*, dorsal setae of first abdominal segment, × 260.

PLATE 9.

FIG. 22. *Achorutes brevispinus*, right postantennal organ, × 1640.
23. *Achorutes brevispinus*, right postantennal organ, × 1120.
24. *Achorutes brevispinus*, left fore foot, × 422.
25. *Achorutes brevispinus*, right mucro, × 1120.
26. *Achorutes brevispinus*, right mucro, × 1120.
27. *Achorutes brevispinus*, anal spine, × 504.
28. *Achorutes brevispinus*, dorsal setae, × 346.
29. *Achorutes packardi*, right postantennal organ, × 1120.
30. *Achorutes packardi*, right hind foot, × 520.
31. *Achorutes packardi*, left dens and mucro, × 520.
32. *Achorutes packardi*, left anal spine, × 386.
33. *Achorutes packardi*, dorsal setae of first abdominal segment, × 386.

PLATE 10.

FIG. 34. *Achorutes packardi*, var. *dentatus*, left hind foot, × 290.
35. *Achorutes packardi*, var. *dentatus*, lateral aspect of left mucro, × 390.
36. *Achorutes packardi*, var. *dentatus*, lateral aspect of left mucro, × 390.
37. *Achorutes packardi*, var. *dentatus*, lateral aspect of left mucro, × 390.
38. *Achorutes packardi*, var. *dentatus*, dorso-lateral aspect of right mucro, × 390.
39. *Achorutes packardi*, var. *dentatus*, dorsal aspect of right mucro, × 390.
40. *Achorutes packardi*, var. *dentatus*, left anal spine, × 82.
41. *Achorutes packardi*, var. *dentatus*, dorsal setae of first abdominal segment, × 110.
42. *Achorutes socialis*, eyes of left side, × 260.
43. *Achorutes socialis*, right postantennal organ, × 840.
44. *Achorutes socialis*, olfactory hairs of fourth antennal segment of right side, × 260.
45. *Achorutes socialis*, sense organ of third antennal segment of left side, × 840.
46. *Achorutes socialis*, right hind foot, × 580.

Plate 11.

Fig. 47. *Achorutes socialis*, left dens and mucro, × 350.
48. *Achorutes socialis*, dorsal aspect of right mucro, × 365.
49. *Achorutes socialis*, left anal spine, × 110.
50. *Achorutes socialis*, dorsal setae of first abdominal segment, × 110.
51. *Achorutes harveyi*, eyes of left side, × 290.
52. *Achorutes harveyi*, right postantennal organ, × 840.
53. *Achorutes harveyi*, left hind foot, × 365.
54. *Achorutes harveyi*, lateral aspect of left dens and mucro, × 365.
55. *Achorutes harveyi*, dorso-lateral aspect of left dens and mucro, × 365.
56. *Achorutes harveyi*, dorsal aspect of right mucro, × 580.
57. *Achorutes harveyi*, left anal spine, × 365.
58. *Achorutes harveyi*, dorsal setae of first abdominal segment, × 82.

Plate 12.

Fig. 59. *Achorutes humi*, eyes of right side, × 840.
60. *Achorutes humi*, right postantennal organ, × 1230.
61. *Achorutes humi*, sense organ of third antennal segment of right side, × 840.
62. *Achorutes humi*, left hind foot, × 840.
63. *Achorutes humi*, left mucro, × 1230.
64. *Achorutes humi*, right mucro, × 1230.
65. *Achorutes humi*, anal spine, × 1230.
66. *Achorutes humi*, dorsal setae of first abdominal segment, × 350.
67. *Achorutes tullbergi*, eyes of right side, × 415.
68. *Achorutes tullbergi*, right postantennal organ, × 1230.
69. *Achorutes tullbergi*, sense organ of third antennal segment of right side, × 1230.
70. *Achorutes tullbergi*, right hind foot, × 840.
71. *Achorutes tullbergi*, right mucro, × 840.
72. *Achorutes tullbergi*, left anal spine, × 350.
73. *Achorutes tullbergi*, dorsal setae of first abdominal segment, × 350.

Plate 13.

Fig. 74. *Achorutes macgillivrayi*, left postantennal organ, × 1230.
75. *Achorutes macgillivrayi*, right postantennal organ, × 840.
76. *Achorutes macgillivrayi*, sense organ of third antennal segment of left side, × 840.
77. *Achorutes macgillivrayi*, left hind foot, × 490.
78. *Achorutes macgillivrayi*, left mucro, × 840.
79. *Achorutes macgillivrayi*, anal spine, × 490.
80. *Achorutes macgillivrayi*, anal spines, × 350.
81. *Achorutes, macgillivrayi*, dorsal setae of first abdominal segment, × 110.
82. *Achorutes viaticus*, eyes of left side, × 260.
83. *Achorutes viaticus*, right postantennal organ, × 840.
84. *Achorutes viaticus*, left hind foot, × 276.
85. *Achorutes viaticus*, right mucro, × 350.
86. *Achorutes viaticus*, left mucro, × 450.
87. *Achorutes viaticus*, anal spine, × 350.
88. *Achorutes viaticus*, dorsal setae of first abdominal segment, × 110.

PLATE 14.

FIG. 89. *Achorutes guthriei*, left postantennal organ, × 840.
90. *Achorutes guthriei*, sense organ of third antennal segment of right side, × 840.
91. *Achorutes guthriei*, left fore foot, × 840.
92. *Achorutes guthriei*, right mucro, × 840.
93. *Achorutes guthriei*, anal spine, × 260.
94. *Achorutes guthriei*, dorsal setae of first abdominal segment, × 520.
95. *Achorutes pseudarmatus*, eyes and postantennal organ of left side, × 260.
96. *Achorutes pseudarmatus*, olfactory hairs of fourth antennal segment of left side, × 490.
97. *Achorutes pseudarmatus*, sense organ of third antennal segment of right side, × 840.
98. *Achorutes pseudarmatus*, right hind foot, × 735.
99. *Achorutes pseudarmatus*, lateral aspect of left mucro, × 840.
100. *Achorutes pseudarmatus*, dorsal aspect of left mucro, × 840.

PLATE 15.

FIG. 101. *Achorutes pseudarmatus*, anal spine, × 260.
102. *Achorutes pseudarmatus*, anal spine, × 490.
103. *Achorutes pseudarmatus*, dorsal setae of first abdominal segment, × 260.
104. *Achorutes armatus*, eyes and postantennal organ of left side, × 397.
105. *Achorutes armatus*, right postantennal organ, × 840.
106. *Achorutes armatus*, olfactory hairs of fourth antennal segment of right side, × 490.
107. *Achorutes armatus*, sense organ of third antennal segment of right side, × 840.
108. *Achorutes armatus*, eversible sac of left antenna, × 260.
109. *Achorutes armatus*, left hind foot, × 840.
110. *Achorutes armatus*, unguis, showing lateral teeth, × 840.
111. *Achorutes armatus*, lateral aspect of left mucro, × 840.
112. *Achorutes armatus*, lateral aspect of right mucro, × 840.
113. *Achorutes armatus*, dorsal aspect of right mucro, × 840.

PLATE 16.

FIG. 114. *Achorutes armatus*, anal spine, × 260.
115. *Achorutes armatus*, anal spine, × 364.
116. *Achorutes armatus*, anal spines, × 260.
117. *Achorutes armatus*, dorsal setae of first abdominal segment, × 260.
118. *Achorutes glasgowi*, left postantennal organ, × 1230.
119. *Achorutes glasgowi*, olfactory hairs of fourth antennal segment of left side, × 490.
120. *Achorutes glasgowi*, sense organ of third antennal segment of right side, × 1230.
121. *Achorutes glasgowi*, right hind foot, × 735.
122. *Achorutes glasgowi*, dorsal aspect of furcula, × 350.
123. *Achorutes glasgowi*, lateral aspect of right mucro, × 840.
124. *Achorutes glasgowi*, dorsal aspect of left mucro, × 840.
125. *Achorutes glasgowi*, anal spines, × 1230.
126. *Achorutes glasgowi*, dorsal setae of first abdominal segment, × 260.

PLATE 17.

FIG. 127. *Achorutes uniunguiculatus*, eyes of left side, × 350.
128. *Achorutes uniunguiculatus*, left postantennal organ, × 1230.
129. *Achorutes uniunguiculatus*, sense organ of third antennal segment of left side, × 1230.
130. *Achorutes uniunguiculatus*, right hind foot, × 840.
131. *Achorutes uniunguiculatus*, left dens and mucro, × 350.
132. *Achorutes uniunguiculatus*, left mucro, × 840.
133. *Achorutes uniunguiculatus*, left mucro, × 840.
134. *Achorutes uniunguiculatus*, anal spines, × 840.
135. *Achorutes uniunguiculatus*, lateral aspect of left anal spine, × 1230.
136. *Achorutes uniunguiculatus*, dorsal setae of first abdominal segment, × 350.
137. *Xenylla humicola*, eyes of left side, × 268.
138. *Xenylla humicola*, left fore foot, × 470.
139. *Xenylla humicola*, left dens and mucro, × 260.
140. *Xenylla humicola*, left mucro, × 1230.
141. *Xenylla humicola*, left mucro, × 840.
142. *Xenylla humicola*, anal spines, × 470.

PLATE 18.

FIG. 143. *Xenylla baconae*, sense organ of third antennal segment of left side, × 1230.
144. *Xenylla baconae*, right hind foot, × 840.
145. *Xenylla baconae*, left aspect of furcula, × 260.
146. *Xenylla baconae*, left mucro, × 840.
147. *Xenylla baconae*, anal spines, × 350.
148. *Xenylla baconae*, anal spine, × 840.
149. *Xenylla baconae*, dorsal setae of mesonotum, × 260.
150. *Xenylla welchi*, sense organ of third antennal segment of left side, × 840.
151. *Xenylla welchi*, right hind foot, × 840.
152. *Xenylla welchi*, left aspect of furcula, × 350.
153. *Xenylla welchi*, left dens and mucro, × 840.
154. *Xenylla welchi*, left mucro, × 1230.
155. *Xenylla welchi*, anal spines, × 350.
156. *Xenylla welchi*, anal spine, × 840.
157. *Xenylla welchi*, dorsal setae of first abdominal segment, × 350.

PLATE 19.

FIG. 158. *Xenylla gracilis*, extremity of abdomen (from Guthrie).
159. *Xenylla gracilis*, anal spines (from Guthrie).
160. *Xenylla gracilis*, eyes of right side (from Guthrie).
161. *Xenylla gracilis*, furcula (from Guthrie).
162. *Xenylla maritima*, left mid foot, × 840.
163. *Xenylla maritima*, left dens and mucro, × 840.
164. *Xenylla maritima*, anal spines, × 840.
165. *Xenylla maritima*, anal spine, × 1230.
166. *Xenylla maritima*, dorsal setae of first abdominal segment, × 260.
167. *Friesea caldaria*, anal spines (from Guthrie).
168. *Friesea caldaria*, anal spine (from Guthrie).
169. *Pseudachorutes aureofasciatus*, eyes and postantennal organ of left side, × 450.
170. *Pseudachorutes aureofasciatus*, dorsal aspect of head, × 86.
171. *Pseudachorutes aureofasciatus*, left fore foot, × 480.
172. *Pseudachorutes aureofasciatus*, mucro, × 450.
173. *Pseudachorutes aureofasciatus*, modified hair, × 280.

PLATE 20.

FIG. 174. *Pseudachorutes complexus*, eyes of left side, × 140.
175. *Pseudachorutes complexus*, left postantennal organ, × 450.
176. *Pseudachorutes complexus*, dorsal aspect of left antenna, × 45.
177. *Pseudachorutes complexus*, buccal cone, × 54.
178. *Pseudachorutes complexus*, right hind foot, × 140.
179. *Pseudachorutes complexus*, left dens and mucro, × 200.
180. *Pseudachorutes complexus*, dorsal setae of third abdominal segment, × 54.
181. *Pseudachorutes lunatus*, eyes and postentennal organ of left side, × 290.
182. *Pseudachorutes lunatus*, left postantennal organ, × 840.
183. *Pseudachorutes lunatus*, left fore foot, × 840.
184. *Pseudachorutes lunatus*, right dens and mucro, × 350.
185. *Pseudachorutes lunatus*, left mucro, × 840.
186. *Pseudachorutes lunatus*, dorsal setae of first abdominal segment, × 290.

PLATE 21.

FIG. 187. *Odontella ewingi*, eyes of right side, × 260.
188. *Odontella ewingi*, right postantennal organ, × 840.
189. *Odontella ewingi*, spine from head, × 840.
190. *Odontella ewingi*, ventral aspect of head, × 46.
191. *Odontella ewingi*, right fore leg, × 125.
192. *Odontella ewingi*, right fore foot, × 350.
193. *Odontella ewingi*, unguis, showing lateral teeth, × 350.
194. *Odontella ewingi*, dorsal aspect of dentes and mucrones, × 260.
195. *Odontella ewingi* dorsal setae of metathorax, × 260.
196. *Odontella ewingi*, integumentary tubercles at end of abdomen, right side, × 260.
197. *Odontella ewingi*, cuticular pattern, × 840.

PLATE 22.

FIG. 198. *Anurida maritima*, eyes and postantennal organ of right side, × 142.
199. *Anurida maritima*, left postantennal organ, × 1230.
200. *Anurida maritima*, sense organ of third antennal segment of left side, × 840.
201. *Anurida maritima*, left hind foot, × 260.
202. *Anurida maritima*, dorsal setae of second abdominal segment, × 82.
203. *Anurida tullbergi*, postantennal organ (after Carl).
204. *Anurida tullbergi*, olfactory hairs of left antenna (after Ågren).
205. *Anurida tullbergi*, unguis (after Carl).
206. *Anurida amorita*, eyes and postantennal organ of right side, × 150.
207. *Anurida amorita*, left postantennal organ, × 325.
208. *Anurida amorita*, right postantennal organ, × 325.
209. *Anurida amorita*, dorsal aspect of right antennal organ, × 275.
210. *Anurida amorita*, left mid foot, × 150.
211. *Anurida amorita*, right fore foot, × 225.
212. *Anurida granaria*, left postantennal organ, × 567.
213. *Anurida granaria*, right postantennal organ, oblique aspect, × 567.
214. *Anurida granaria*, right fore foot, × 474.
215. *Paranura caeca*, olfactory hairs of fourth antennal segment of right side, × 260.
216. *Paranura caeca*, sense organ of third antennal segment of right side, × 840.

PLATE 23.

FIG. 217. *Paranura caeca*, mandible, × 1230.
218. *Paranura caeca*, maxilla, × 1230.
219. *Paranura caeca*, right fore foot, × 460.
220. *Paranura caeca*, left hind foot, × 525.
221. *Paranura caeca*, dorsal seta of first abdominal segment, × 85.
222. *Neanura muscorum*, eyes of left side, × 197.
223. *Neanura muscorum*, left fore foot, × 260.
224. *Neanura muscorum*, tubercle of head, × 197.
225. *Neanura muscorum*, maxilla, × 840.
226. *Neanura gigantea*, eyes of left side ,× 95.
227. *Neanura gigantea*, left postantennal organ, × 325.
228. *Neanura gigantea*, hind foot, × 74.
229. *Neanura magna*, diagram of tubercles of fourth and fifth abdominal segments, × 23.
230. *Neanura magna*, left hind foot, × 240.

PLATE 24.

FIG. 231. *Neanura serrata*, eyes of right side, × 260.
232. *Neanura serrata*, olfactory hairs of fourth antennal segment of left side, × 490.
233. *Neanura serrata*, sense organ of third antennal segment of right side, × 840.
234. *Neanura serrata*, right hind foot, × 260.
235. *Neanura serrata*, serrate seta, × 260.
236. *Neanura ornata*, head; eyes indicated by *e*, *e*, *e*, × 74.
237. *Neanura ornata*, left antenna, × 95.
238. *Neanura ornata*, ventral aspect of head, × 45.
239. *Neanura ornata*, metanotal setae, × 325.
240. *Neanura ornata*, left fore foot, × 275.

PLATE 25.

FIG. 241. *Neanura quadrioculata*, dorsal aspect of head, × 85.
242. *Neanura quadrioculata*, eyes of left side, × 490.
243. *Neanura quadrioculata*, olfactory hairs of right antenna, × 490.
244. *Neanura quadrioculata*, ventral aspect of head, × 85.
245. *Neanura quadrioculata*, left hind foot, × 735.
246. *Podura aquatica*, eyes of left side, × 260.
247. *Podura aquatica*, sense organ of third antennal segment of right side, × 460.
248. *Podura aquatica*, left foot, × 260.
249. *Podura aquatica*, left aspect of tenaculum, × 377.
250. *Podura aquatica*, right mucro, × 490.